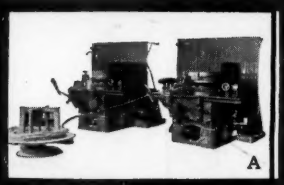
WIRE & WIRE PRODUCTS

VAUGHN MOTOBLOC

(PATENT APPLIED FOR)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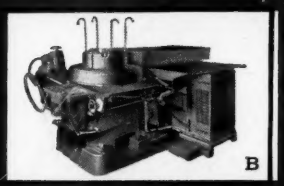
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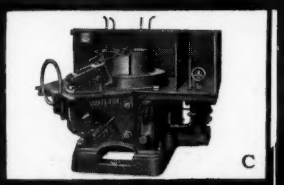
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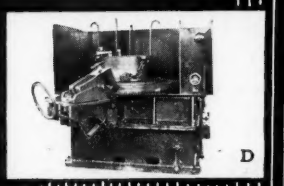
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NO matter what size or style of wire drawing machines required in your mill, there's a VAUGHN MOTOBLOC to meet your every production need.

VAUGHN MOTOBLOCS are now available for drawing anything between No. 20 gauge and 1 inch diameter wire, and can be built in a number of different styles to meet different conditions.

For example—illustration "A", to the left, shows a No. 12 Motobloc equipped with double deck block for drawing two holes simultaneously.

Illustration "B" shows a No. 13 Motobloc arranged with two die holder brackets for drawing either single or in tandem.

Illustrations "C" and "D" show the standard No. 12 and No. 12-22 Motobloc.

Noted throughout the wire industry for their high production and their neat, compact design, VAUGHN MOTOBLOCS offer you gilt edged investment in modern wire drawing machinery.

VAUGHN MACHINERY CO.
CUYAHOGA FALLS, OHIO

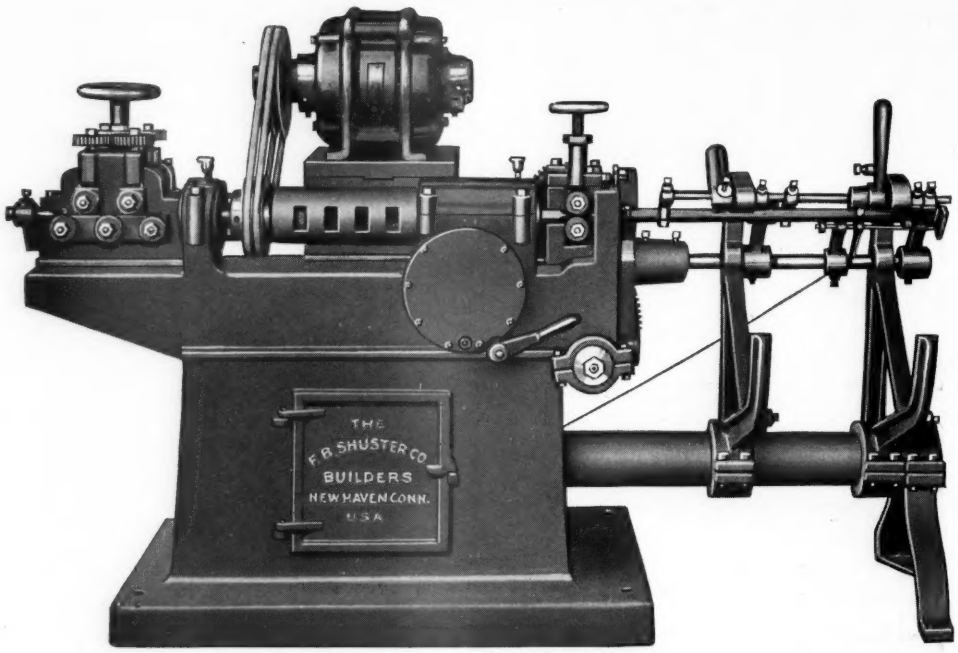
Export Office
420 Lexington Ave.
New York, N. Y.

We also manufacture a complete line of continuous copper wire drawing machines, draw-benches for bars, and other machinery for wire mills.

VAUGHN MACHINERY COMPANY,
CUYAHOGA FALLS, O.

SHUSTER

Automatic Wire Straightening and Cutting Machinery



WE are showing this month a self contained motor driven Machine, equipped with a five roll straightener which rough straightens the stock before it enters the rotary head, and which is a valuable addition on some kinds of wire.

The straightening head is of steel, and mounted in Timken Roller Bearings—Bearings are bronze bushed, etc.

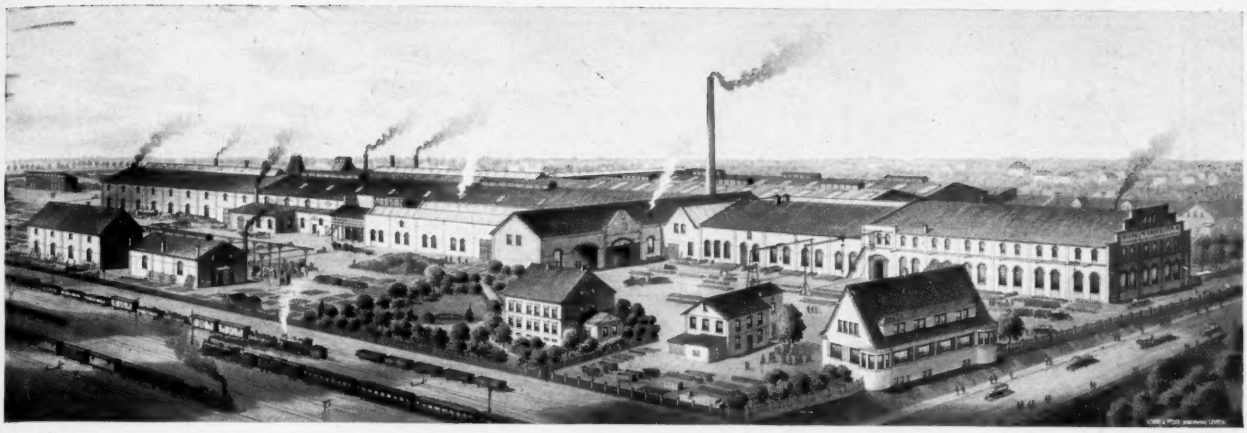
Makes the wire perfectly straight, at high speed, and cuts absolutely accurate lengths day after day for years, with little attention either for operation or maintenance.

Can we tell you more about it?

The F. B. Shuster Co. **New Haven, Conn.**

Formerly John Adt & Son ***STRAIGHTENER SPECIALISTS*** **Established 1866**

WIRE & WIRE PRODUCTS, Vol. 3, No. XI, November, 1928. Publication office, 59 East Washington Ave., Washington, N. J. Executive office, 551 Fifth Avenue, New York, N. Y. Published by the Quinn-Brown Publishing Corp., Richard E. Brown, President; Frank Quinn, Secretary and Treasurer. Subscription price: U. S. and Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class mail at the Post Office at Washington, N. J., under the Acts of March, 1879, and copyright, 1928, by Quinn-Brown Publishing Corporation.



For the first time, the firm of

WILHELM BREITENBACH

(of Unna, Westfalia, Germany)

offers its products to the American wire industry through this advertising medium. The Breitenbach machines have been for decades installed in most of the leading wire factories of Germany and numerous important plants in all other parts of the European continent.

The firm of Wilhelm Breitenbach, established in 1863, has for 60 years been solely occupied with the construction of wire working machines, and it therefore possesses an unusual experience in this line.

A large equipment of special machines and the fact that the machines are constructed from raw material to finished product right in the shop itself, enables us to quote very low prices and, furthermore, the quality of the machines is unsurpassed.

The Various Main Products are the following:

1. **FOR FRICTION, HEAVY AND MEDIUM DRAWING,** of standard as well as special design protected by patent. The special features are the unsurpassed screw spring friction coupling of special design as well as the shaft in ball bearings, patent protected, covered by an oil casing.
2. **FOR FINE DRAWING AND VERY FINE DRAWING** in standard and special designs. The following machines are especially worthy of mention:
   - **a.** For fine drawing and very fine drawing with screw spring friction coupling adapted for special wires.
   - **b.** For fine drawing and very fine drawing with quick disengaging coupling, especially for steel wire.
   - **c.** For very fine drawing with attached winding device, especially for wire rope.
3. **MULTIPLE DRAWING MACHINES** designed especially for iron wire from 2.2 mm up (patented design). Drawing rollers and drawing stones are entirely cooled in the drawing liquid during operation. For iron wire from 2.2 down to 0.8 mm, the output of 1000 kilos per laborer in 8 hours is unexcelled.
4. **WINDING APPARATUS,** with special drive or gear, for steel wire hardening and galvanizing plants. Made for wire of all dimensions.
5. **RAPID WINDERS** for respooling galvanized wires, **WIRE WASHING, WIRE POINTING** machines and similar machinery.

The American wire industry also needs these machines, because they are highly developed in every respect.

Expert representatives who are in close relations with the American wire industry are wanted.

WILHELM BREITENBACH, Unna (Westfalia, Germany)

Machines for Wire Production

An Announcement of Improved Service Facilities

OUR removal to the office we now occupy in the **Hudson Terminal Building, 30 Church Street, New York City,** has provided spacious and conveniently located headquarters for our expanding business in machinery for the wire industry. The new location is in the heart of the metals and machinery trading district. We ask that you make note of the new address and we take pleasure in extending a cordial invitation to call.

High Productive:
- **Bolt Presses**
- **Nut Presses**
- **Rivet Presses**
- **Chain Forming Machines**
- **Pin and Needle Machines**
- **Point Grinding Machines**
- **Poultry Netting Machines**
- **Wire Staple Machines**
- **Wire Spooling Machines**
- **Wire Weaving Machines**

Expert Engineering Service available at all times

M. A. IRMISCHER

Machinery for the Wire Industry

30 Church Street, New York, N. Y.

Telephone: Cortland 5481

IN the files of material before us for inclusion in the next annual directory of the industry there are upward of eight hundred classifications of wire, wire products, and the materials and equipment entering into their manufacture.

Even this impressive figure falls far short of being exhaustive. The morning newspapers carry a story under a London date line about an inventor who has perfected a device for "storing" a telephone message in a few inches of magnetized wire attached to an ordinary telephone receiver. Still newer, if less significant, uses of wire are doubtless being developed every day.

The point we want to make here is that any directory of the wire industries, however painstakingly compiled, is subject to errors and omissions that will creep in and be overlooked despite exacting precautions. It will be our earnest effort to keep these down to the minimum.

Here is where an ounce of prevention is worth tons of cure. No one in the industries represented in what aims to be a complete directory and buyers' guide of wire and wire products and wire mill equipment wishes more heartily than we do that the next edition will be as nearly perfect as it is humanly possible to make such a reference work.

Our compilation and revision has been going on for weeks in preparation for January publication. If several separate notices have escaped your attention, please consider this a reminder to get your products listed, your firm name correctly printed, your address properly filed for reference. A list on your letter-head will serve the purpose nicely, and there is no time like the present. Thank you.

The Publishers

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 3 **November, 1928** **No. 11**

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Krupp-Made Widia Metal and Wallramite Used Exclusively in These Dies

The fact remains that the European competitor is able to undersell the American Wire Manufacturer, in spite of heavy duty and transportation charges.

What Made it Possible?

The following will throw some light on the subject:

1. Die cost is reduced to a minimum with UN-WIDIA and WALLRAMITE dies, which have replaced the chilled iron, steel and in the case of hard wire, diamond dies.
2. Production per machine is increased from 25% to 35% due to increased drawing speed and continuous drawing with UN-WIDIA and WALLRAMITE dies.
3. Quality of the wire is much finer at a decreased cost.
4. With better quality of wire from the coarse wire machine, the diamond dies last twice as long on size when redrawing on fine wire.
5. Labor is reduced in direct proportion to machine production.
6. Die room cost is cut 75% and more.
7. Many of the usual cleaning operations are eliminated by the use of UN-WIDIA and WALLRAMITE dies.

UN-WIDIA AND WALLRAMITE DIES ARE MANUFACTURED AND SOLD EXCLUSIVELY BY THE

UNION WIRE DIE CORP.

Manufacturers of diamond and alloy metal dies

250 WEST 40 STREET NEW YORK CITY

WIRE & WIRE PRODUCTS

Vol. 3 NOVEMBER, 1928 No. 11

Worcester Wire Mills Report Improved Business

Survey of leading producers in the industry indicates bright outlook for coming months

THE wire mills of Worcester, Mass., and neighboring communities are much busier than they were last year or early this year. Orders received necessitate a heavier production and the mills are approaching much nearer to maximum capacity, according to a survey made by the Worcester Bank & Trust Company. The report states that "most of the companies have either extended their plants or added new equipment for old. These improvements started last year, when the outstanding undertaking was the establishment of the $2,000,000 billet and rod mill at South Works of the American Steel & Wire Company. Taking all of the local companies as a unit possible production has increased to an important extent, which means some additional employment, but chiefly larger machine production. Increased capacity does not mean increased number of employees to the same extent that it did up to comparatively recent times."

American Steel and Wire

Clinton S. Marshall, district manager of the American Steel & Wire Company, describes conditions as they affect the company's Worcester district, as follows:

"General business conditions at the present time are somewhat improved over the early part of the year and considerably better than a year ago. I believe that the outlook for the wire industry for the early winter—and certainly for next year—is very promising. We are at present experiencing a demand for high grade specialty wires which is very encouraging and which has every evidence of being permanent.

Wheeldon Wire Company

The experience of the Wheeldon Wire Company, as told by Treasurer Charles H. Sparrell, follows:

"Our business has increased over what it was earlier in the year and as compared with a year ago. The outlook in the wire industry is good, as with increasing demands for wire in all the older lines and new uses coming up continually, the general tonnage is bound to increase.

"We have increased our capacity during the past year, by the erection of new fire-proof tinning and galvanizing and annealing buildings, as well as by improved and new fireproof cement construction in old buildings, together with the addition of a heavy 10-block rod frame, several new cold rolling mills and take-ups, several new galvanizing and tinning take-ups and several new twisting and straightening machines as well as additional annealing furnaces and equipment.

"Also we have added special twisted and straightened wires and many special soft wires for special requirements to our products, while continuing to specialize in high carbon wires from both domestic and Swedish steels."

The Johnson Steel & Wire Company, Inc., states: "We find that business is just as brisk now as it was in the early part of the year in spite of the impending presidential election. We look for a continuance of this condition for the balance of the year, and expect that next year will prove to be at least a normal year for the wire industry.

Worcester Wire Works

The Worcester Wire Works, which has enlarged its plant so as to give one-third more out-

(*Please turn to page 392*)

Chemical Tests of Wire

No laboratory equipment is required for many useful tests that reveal characteristic defects in bare and galvanized wire

By J. D. Brunton

Brunton's Research Laboratory, Musselburgh, Scotland

THE chemical testing of wire is very often of great importance to the consumer. It is not proposed to deal with the actual chemical composition of the steel and the methods usually adopted for the determination of the various elements as this comes more under the domain of the metallurgical chemist, but there are a number of chemical tests which are extremely useful when dealing with wire and these can be applied without the necessity of having a chemical laboratory.

In the process of wire making we experience now and again wire breaking with a "cuppy" fracture or what is often termed in the trade, "a cup and cone break." When wire is being drawn quite normally sometimes it will not stand the reduction and eventually it breaks with a cup and cone break, a typical example being shown herewith.

Causes of Cuppy Fractures

The chief cause of this is that the core of the metal or wire is harder than the outside and in drawing the wire through a die the crystals on the outside are deformed into their new position, but, the inside of the wire being so much harder than the outside refuses to flow at the same rate. The consequence is that eventually the wire breaks and the cup and cone fracture is formed. The probable reason of this is that axial segregation has taken place when the original ingot was cooled, and in the subsequent rolling and drawing this segregation cannot be disturbed but is elongated in the billets, then in the rods, and finally in the centre of the drawn wire.

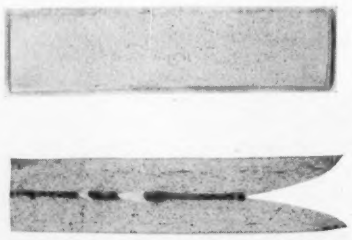
The greatest segregation of impurities in steel always occurs round the point that is longest liquid in the ingot, which is naturally the center. This is the

FOLLOWING Mr. Brunton's description, in preceeding contributions, of mechanical and magnetic tests for steel wire defects, the accompanying paper will be found particularly interesting because it is confined to tests that do not require the elaborate technique or facilities of the metallurgical chemist. These tests can be applied in a small way by the manufacturer or user. Next month's article in the series will deal with tests for tinned wire.

cause of axial segregation and below are given figures of an actual wire which broke in the drawing due to this segregation. The wire in question was analysed, both the outside and the inside being turned, and the turnings analysed separately.

	Center	Outside
Carbon	.815	.70
Silicon	.177	.168
Manganese	.76	.69
Sulphur	.032	.013
Phosphorus	.050	.012

Some of the elements do not matter, but others do and one of the greatest offenders is sulphur. Fortunately a simple experiment, to ascertain if there has been segregation of sulphur in the steel or not, is possible. This is done by means of a sulphur print and the presence of sulphur, especially when segregated, can be often very clearly revealed by this process.



Sulphur Prints made by direct contact of the specimen with sensitized paper. The good wire (above) shows an even color throughout. The dark brown streaks in the lower print reveal areas containing excess sulphur.

The sample to be tested should be filed flat and then rubbed on two or three grades of emery paper, each one finer than the previous one, and finally finished on French emery paper, number O. Sheets of Bromide paper (ordinary photographic printing paper) are used and these are soaked in a 2% solution of Sulphuric Acid. After thoroughly soaking, the paper is placed on a piece of glass plate and the steel section, after washing well to remove any dirt or grit, is gently pressed on the paper for a matter of some thirty seconds, after which time the specimen is removed and the paper which contains the print is washed, placed in sodium hyposulphite solution to remove the excess bromide, washed and dried.

It will be seen at once from this print, more so if any area contains a large amount of sulphur, that some parts are very dark brown, in fact nearly black, and these are the areas containing the excess sulphur.

The reaction between the acid and the sulphides, wherever present, generates sulphuretted hydrogen, which in turn reacts on the silver bromide of the paper and forms silver sulphide, which is black and varies in intensity according to the amount of sulphur the steel contains and reveals the areas where it is situated.

Acid Test For Detection of Segregated Areas

Another chemical test, which is rather drastic but which is, nevertheless, useful for picking out segregated areas and other defects in wires, strip, etc., such as laps, seams, etc., is as follows.

The piece of wire, rod or bar is carefully cleaned to remove any grease or oil by washing in a soda solution or in benzine.

After a thorough cleaning it is placed into boiling diluted hydrochloric acid containing about 50% acid and allowed to boil for 10 minutes. The specimen is then taken out, washed well and dried, after which it is gently ground with emery paper.

The action of the acid on the impure parts of the steel; that is, the areas containing large amounts of impurities such as sulphur, phosphorus, oxides, etc., is more severe than on the pure parts, hence the impure areas are badly pitted and can easily be seen.

Although this method of testing is rather drastic, it is a very good test when examining wire, etc., which has to be used for very important work and it also has the advantage of being a quick method. When wire is being examined for segregation it should be filed to the centre so that the inside of the wire can be acted upon by the acid.

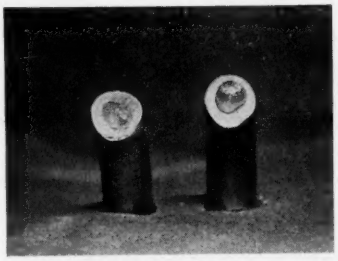
Chemical Tests For Galvanizing

The outward appearance of galvanized wire in not necessarily an indication of the quality of galvanizing. This statement may be taken as the general rule applying to wire coated by any of the various galvanizing processes. For over forty years prior to the year 1880 the hot galvanizing process was practically the only one in commercial use and it was believed to produce uniform results. It was, therefore, deemed unnecessary to test such coatings by any other means than that of durability in actual weather conditions.

Observations made by Sir W. H. Preece, Chief of the G. P. O. Telegraphs of Great Britain, led him to see the necessity of a test for zinc coating on telegraph wires and he devised what is known as the "Preece or Copper Sulphate Test."

The copper sulphate is dissolved in distilled water until a saturated solution is produced. The wire, after having been thoroughly cleaned of any grease or dirt, is immersed in this solution for a period of one minute. after which time it is removed, rinsed in water, wiped, and again immersed in the copper sulphate solution. The number of immersions which the article can withstand before showing a deposit of copper on the underlying steel is taken as an indication of the excellence of the zinc coating.

The latest standardized "Preece" test is as follows: A solution of copper sulphate is made up, consisting of copper sulphate crystals dissolved in



A longitudinal section showing a cuppy fracture in which the skin of the wire is so much softer than the core as to appear to be a separate coating.

cold distilled water, in the proportion of about 36 parts by weight of crystals to 100 parts by weight of water. The solution is then neutralized by the addition of an excess of chemically pure copper oxide. Any excess of copper oxide will be seen by a sediment of this reagent at the bottom of the containing vessel. The neutralized solution is now filtered and the Specific Gravity adjusted to 1186 at 65° F. by adding water if the solution be too dense or by the addition of more copper sulphate solution of a higher specific gravity if it be too low.

The samples to be tested are cleaned of any grease or oil by washing in petrol or benzine. When thoroughly clean the samples are wiped dry and (1) immersed for one minute in the copper sulphate solution, washed and wiped dry, then (2) immersed for one minute, washed and wiped dry. This process of immersion, washing and wiping is continued until a bright copper deposit is formed on the sample. The number of immersions that the steel will stand before showing copper is a test as to its quality. Copper deposited within one inch of the cut ends shall not be considered.

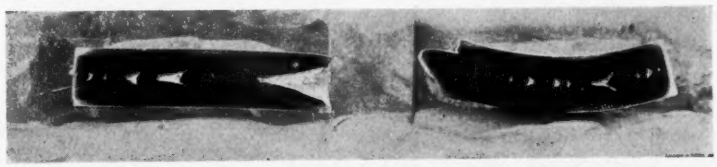
It will be seen by this test that the areas containing the thinnest portion of zinc are the first to have copper deposited and hence the portions thinnest in zinc are the only ones measured. It is, therefore, of no use for determining how much or how little zinc is deposited on the article under test. It is unsatisfactory for sherardized articles, and it is not generally known that the copper sulphate does not attack zinc coating deposited electrically and by hot galvanizing methods at equal rates. It has also been demonstrated that different temperatures at which the article has been galvanized and the different methods of cooling the articles show different results with the copper sulphate test.

From the above it will be seen that the sulphate of copper test is not a comparative one when applied to zinc coatings done by sherardizing, hot galvanizing, spraying and electro galvanizing.

Owing to the unsatisfactory results of the "Preece" Copper Sulphate test, accurate quantitative tests for galvanizing have been devised and the first one is known as the *French Government Test.*

French Government Test

The French Government test for estimating the amount of zinc on zinc coated wires is designed to estimate the actual



Cross-sections of wire specimens showing "cuppy" fractures. Even wire drawn quite normally sometimes exhibits this cup and cone break due to a hard core that does not flow at the same rate as the outside.

weight of the zinc coating formed by any of the processes. It takes into consideration the impurities in the coating—the main impurity; that is, iron, may be determined if desired, but the test is seldom carried out to this extent. The wire is cleaned to remove all grease by immersing in petrol or benzine, washed well with water, and finally wiped with a clean cloth until it is perfectly dry. When dry the sample is carefully weighed to an accuracy of one milligramme and the weight noted.

The sample is then immersed in a 1% solution of sulphuric acid and is allowed to remain in this solution until the vigorous effervescence, due to the action of the acid on the zinc, has entirely ceased. When all action is over the sample is taken out of the acid, washed well and wiped dry. It is again weighed very carefully and the loss in weight represents the amount of zinc on the wire. While it is true that any iron present in the coating will have been dissolved away and estimated as zinc, the amount of iron generally present is so small that it is negligible.

The theory of the process is very simple. Zinc is attacked rapidly by weak acids which would not appreciably attack iron, hence if the sample is taken out of the acid as soon as the action is over the amount of iron attacked is nil or only a trace.

Another method, which is also used for the quantitative estimation of zinc or zinc coated articles, is known as the *Lead Acetate Test.*

The Lead Acetate Test

This Lead Acetate test is similar to the French Government test in that it is possible by it to estimate the actual weight of the coating. Dissolve 3 lbs. of commercial lead acetate crystals in one gallon of distilled water and add 1 oz. of litharge (Lead Oxide). After all the lead acetate has dissolved the mixture should be stirred vigorously and any undisolved residue allowed to settle. The clean liquid is then poured off and the solution is ready for use. It is unnecessary to maintain any accurate temperature and the solution may be used for several tests until such time as the action becomes too slow.

The sample of wire or other article is thoroughly cleaned in petrol or benzine and freed from all grease, etc., then washed in cold water, dried and wiped with a clean cloth. It is weighed to an accuracy of 1 milligram and the weight noted. The sample is then immersed in lead acetate solution. The length of time the sample is under treatment is about three minutes, although it may be left longer without affecting the result. These immersions are repeated until all the coating has been removed and the sample exhibits the clean steel underneath.

After each immersion in the lead acetate solution the flocculent deposit must be carefully removed and this can be done best by a soft bristle brush. When the coating is all removed the sample is dried by immersion in alcohol and igniting or by placing over a small steam coil. The sample is again weighed and the weight noted.

If it is desired to estimate the amount of iron in the coating, the solution and washings must be kept, filtered, and made slightly acid with sulphuric acid. It is advisable to place a few particles of granulated zinc into the solution, which will reduce any iron which may have become oxidized, and then the solution is finally titrated with a standard solution of

(*Please turn to page 384*)

Solubility of Steel Wire in 1 Per Cent Sulphuric Acid

Dead Mild Steel

Size	*Condition*	*Loss in mg/sq. cm. 24hrs*	*48hrs*	*72hrs*	*120hrs*
.210″	As recd.	1.75	2.45	3.39	6.10
.210″	Annealed	1.53	2.53	3.38	6.80
.190″	Drawn 1 pass	1.70	2.55	3.33	6.85
.175″	Drawn 2 passes	1.97	2.75	3.90	6.95
.158″	Drawn 3 passes	1.98	2.71	4.03	7.60
.140″	Drawn 4 passes	1.57	2.69	4.90	10.22
.125″	Drawn 5 passes	1.35	2.61	4.58	10.27

80% Swedish Steel

Size	*Condition*	*Tons per sq. inch*	*Loss in mg/sq. cm. 24 hrs*	*120 hrs*
.212″	Rod for hot rolling	65.0	24.5	537.0
.212″	Patented A. C.	70.0	11.1	435.0
.190″	Drawn 1 pass	75.0	13.0	475.0
.173″	Drawn 2 passes	80.5	14.3	482.0
.150″	Drawn 3 passes	87.4	20.0	505.0
.135″	Drawn 4 passes	96.7	24.3	548.0
.125″	Drawn 5 passes	99.0	24.7	574.0
.123″	Patented	75.0	6.0	50.6
.115″	Drawn 1 pass	82.2	6.66	70.3
.103″	Drawn 2 passes	89.7	10.20	120.3
.094″	Drawn 3 passes	98.7	10.60	137.8
.085″	Drawn 4 passes	109.4	9.70	229.0

.45/.50% Carbon Steel

Size	*Condition*	*Loss in mg/sq.cm 120 hrs.*
.210″	As recd.	26
.202″	Ripped 1 pass.	17
.187″	Ripped 2 passes	32
.182″	Patented.	58
.162″	Drawn 1 pass.	157
.157″	Drawn 2 passes	212
.133″	Drawn 3 passes	233
.114″	Drawn 4 passes	273
.097″	Drawn 5 passes	283
.080″	Drawn 6 passes	321

Service Data Reveal Quality of Trolley Wire

Thirty-two urban railway lines report their experiences with specific sizes and kinds

THIS valuable data about trolley wire performance is here published through the courtesy of the American Electric Railway Association. The information was supplied by responsible operating officials in answer to the following questionaire:

Please give data as outlined below regarding trolley wire installed on your urban lines:
(1) Number of feet of various sizes (1/0-2/0-3/0-4/0), composition (copper, phono-electric, with per cent conductivity, hitenso A. or C. and shape, round or grooved).
(2) Tension of trolley wire at time of installation.
(a) How determined?
(3) Average number of trolley wire breaks per 100,000 car-miles per month.
(4) What size and kind of trolley wire is recommended for urban service where the feeder capacity is ample and the annual number of trolley wheel passes is about 110,000?
(5) Is it your practice to use trolley armor at points where the trolley wire is subjected to excessive wear?

WILLIAMSPORT Railways, Williamsport, Pa.: (1) No record but almost all is 00 round copper wire. (2) No set rule. (5) No.

Toronto Transportation Commission, Toronto, Ont., Canada: (1) 722,760 ft of 40 per cent conductive 00 round phono-electric; 105,600 ft. of 92 per cent conductivity 00 round cadmium; 432,960 ft. of 97 per cent conductivity 00 round hard drawn copper. (2). The practice is to renew the worn trolley wire in cold weather and pull it up as tightly as possible by hand, using a triple block. (3) 0.08 broken trolley wires per 100,000 car-miles in 1927. (4) This depends entirely upon the following conditions: grades, number of curves, weight of train, etc. (5) Yes.

Southern Division, Interstate Power Company, Dubuque, Iowa: (1) Twenty-one miles, 00 round. (2) Trolley wire is pulled up by guess. (3) No record, but not many. (5) No.

Maysville Street Railroad & Transfer Company, Maysville, Ky.: (1) Hard-drawn copper grooved. (2) 4-inch sag to each 100 feet. (a) It is measured with a pole between spans. (3) We have not had a trolley break in the past seven years. (4) It depends on operating conditions (5) No.

Cleveland, Ohio

Cleveland Southwestern Railway & Light Company, Cleveland, Ohio:—(1) About 30 miles. (2) 8 in. slack. (a) By sighting (3) No record (4) 000 round. (5) No, it is not necessary.

Eastern Texas Electric Company, Beaumont, Tex.: (1) 0000 phono 2,725 ft; 0000 copper 4,700 ft; 00 phono-electric 15,600 ft; 00 copper 51,900 ft. (2) Unknown. (a) Drawn up by sight (3) Three per 1,300,000 car-miles per year. (4) 0000 phono-electric (5) No.

Winnipeg Electric Company, Winnipeg, Canada: (1) Three miles cadmium copper 00 round; 117 miles 00 H. D. copper round. (2) Pulled tight by three men on two sets of double-sleeve blocks. (3) 0.573 for last twelve months. (4) 00 H. D. copper. (5) Yes—with good results.

Illinois Power & Light Corporation Peoria, Ill.: (5) Yes, with very good success.

Omaha & Council Bluffs Street Railway, Omaha, Neb.: (1) 836,000 ft. 00 copper; 34,000 ft. 00-60 per cent phono-electric. (2) 2,020 lb. at 0 deg. F., 1,420 at 60 deg. F., 1,100 at 90 deg. F. (a) By a dynamometer. (3) 1.15 breaks per 100,000 miles. (4) 00. (5) Yes.

Madison Railways, Madison, Wis.: (1) Eighteen miles 00 hard-drawn copper. (5) No.

Kentucky Utilities Company, Paducah, Ky.: (1) 9.8 miles 00 hard M. H. D. copper. (3,4,5) We do not have any such points.

Richmond Railways, Inc., Tompkinsville, Staten Island, N. Y.: (1) About 2 miles of 00 copper. (2): (a) No means of determination. (3) About .75. (4) 00 copper. (5) No, we use phono-electric at points of excessive wear.

Pacific Gas & Electric Company, San Francisco, Cal.: (1) Forty-five miles phono-electric 00 round trolley wire. (5) No.

Southern New York Railway, Inc., Mohawk, N. Y.: (1) 316,800 ft. 00 copper trolley round; 238,603 No. 8 copper round a.c.; 2,600 ft. 0000 copper trolley round. (2) 4-in. sag in 100 ft. span. (a) By eye. (3) 1½. (4) 00 copper. (5) No.

Nova Scotia Light & Power Company, Halifax, N. S., Canada: (1) 126,720 ft. 00 round, all copper except at curves where cadmium is used. (2): (a) Only the foreman's judgement is used. (3) One break per year for a three-year period average. (4) 00 is ample. (5) No.

San Francisco

Market Street Railway, San Francisco, Cal.: (1) 2,000,000 ft. round 00 Hitenso C. (2) It varies depending on the topography of the ground and on the condition of the adjacent sections of wire but never depending on temperature. (a) By judgement of linemen or as determined by actual measure-

ment with tension indicating instruments. (3) 0.4. (4) 00 round Hitenso C. (5) No longer.

New Orleans Public Service, Inc., New Orleans, La.: (1) 1,091,867 ft. round 00 phono-electric 40 per cent conductivity; no other type, size or kind in use. (2) At the time the trolley wire is installed, with known spans and temperature, reference is made to a tension chart and the trolley is pulled until the proper tension is shown on a dynamometer. (3) 0.56 trolley breaks per year per 100,000 car-miles. (4) 00 round, 40 per cent conductivity phono-electric. (5) No.

Chicago, North Shore & Milwaukee Railroad, Highwood, Illinois: (1) Seventy-five miles 0000 (standard copper) grooved; 103½ miles 000 (standard copper) grooved; 42 miles 0000 (phono-electric) grooved. (2) We use the tension recommended by the manufacturer. (a) By a dynamometer in blocks. (3) Average number of breaks per year, 35; average number of car-miles per month, 822,500. (4) 000 (standard copper) grooved. (5) No.

Birmingham, Ala.

Birmingham Electric Company, Birmingham, Ala.: (1) Total feet of trolley wire in system are 1,068,500 consisting mostly of 00 grooved copper wire. Within the past two years we have installed about 20,000 ft. of phono-electric, 60 per cent conductivity wire, 8,000 ft. of Hitenso A and about 10,000 ft. of cadmium composition trolley wire. These are being tried out as an experiment. (2) Tension of trolley wire is about 1,000 lb. when shaded thermometer temperature is around 75 deg. (a) Tension is not measured but wire is strung by sagging. (3) 1.2 per 100,000 car-miles per month. (4) We have used 000 grooved copper trolley wire for a great many years and find it reasonably satisfactory. At points of excessive wear where traffic is heavy and curves are severe we are trying out a higher strength wire in an endeavor to reduce the number of breaks. We have not had it in service long enough to form a definite conclusion. (5) It is not our practice to use trolley armor but we have installed a few pieces as an experiment; no conclusion has been reached yet.

Memphis Street Railway, Memphis, Tenn.: (1) 99,742 ft. 00 round, low conductivity; 35,900 ft. 0000 round, low conductivity; 35,900 ft. 0000 round, low conductivity. (2) Trolley wire is installed by sag as specified by A.E.R.E.A. (3) 0.2 (4) 00 phonoelectric trolley wire. (5) Yes.

El Paso, Texas

El Paso Electric Company, El Paso, Tex.: (1) 40.5 miles 00 hard-drawn round; 1.5 miles 00 phono-electric round. (2): (a) It is left to the judgment of the trolley foreman. (3) 0.4. (4) 00 round, hard-drawn copper. (5) No.

Pittsburgh Railways, Pittsburgh, Pa.: (1) 00 round, hard-drawn copper, 3,034,777 ft.; 00 round, silicon bronze (test), 2,650 ft.: 00 round 40 per cent conductivity bronze, 52,800 ft.; 0000 grooved, 85 per cent conductivity phono-electric (catenary), 3,600 ft.; total trackage 3,093,827 ft., 858.99 miles. (2) The tension of the trolley wire at time of installation is approximately 1,200 lb. (a) The tension is determined by the sag between the spans.

(4) 40 per cent conductivity bronze trolley wire has been unsatisfactory on our system. On constant grades or car acceleration points, 40 per cent shows excessive burning, thus decreasing the cross-section. Down grade installations are satisfactory.

Considering the present standards on our property, we would recommend the use of 00 round copper or 85 per cent conductivity bronze wire. (5) Yes.

Utah Light & Traction Company, Salt Lake City, Utah.: (1) 601,920 ft. 00 copper (round) 2,100 ft.; 0 copper (round). (2) 2,000 lb. (a) With a spring balance. (3) One. (4) 00. (5) No.

Los Angeles Railway Corporation, Los Angeles, Cal.: (1) Approximately 500 miles 000 hard-drawn copper D.-G. (2) Approximately 3,000 lb. (a) By dynamometer, capacity 8,000 lb. (3) For the year 1927: 0.69 (100,000 car-miles per year). (4) Hitenso 000 D.-G. (5) We do not use trolley armor. We have made experiments but it was not very satisfactory.

Honolulu Rapid Transit Company, Honolulu, Hawaii: (1) 200,000 ft. 000 grooved trolley. (2) Not measured. (3) 0.5 trolley wire breaks per 100,000 car-miles. 1.0 trolley wire breaks per month; 200,000 car-miles per month. (4) 00. (5) Yes.

Denver Tramway, Denver, Col.: (1) 0, 39,152 ft.; 00, 195 ft.; 0000, 219,896 ft.; silicon-bronze, 13,813 ft. (2) The standard sag table is followed. (a) From standard sag table—A.E.R.E.A. edition 1926. (3) 0.4. (4) 00. (5) Yes.

Baltimore, Md.

United Railways & Electric Company of Baltimore, Baltimore, Md.: (1) Following are the number of feet of trolley wire installed on main line tracks: 00 AWG—Copper, 540,509; 40 per cent bronze, 374,973; 65 per cent bronze, 24,860; 90 per cent bronze, 101,287; total 00 AWG, 1,1041,629. 000 AWG—Copper, 86,305; 65 per cent bronze, 632,577; 90 per cent bronze, 348,112; total 000 AWG, 1,066,994. (2) Trolley wire is erected to a definite tension determined by a dynamometer, depending upon the prevailing temperature conditions (a blueprint copy of the curves used showing relation of tension to temperature is on file at association headquarters). (3) 0.0442 on main line trolley during year 1927. (4) We are standardizing on 000 A.w.g. size, high conductivity bronze wire. The use of one size of wire will minimize the wearing effect of the groove in trolley wheels, which we have found punishes the wire severely. (5) Yes, at frog approaches, etc.

Atlanta Division Georgia

(*Please turn to page 388*)

Critical Annealing Temperatures of Brass Wire

A series of tests shows a range of temperatures having unfavorable effects on mechanical properties

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(Translated by Paul H. Wueller)

IF one increases the annealing temperature of cold-drawn brass-wire containing from 63.5% to 64.0% copper, one simultaneously increases the elongation of the wire, whereas one decreases its tensile-strength. The elongation reaches its maximum value between 600° and 700°C, but decreases if the temperature if further raised. If one anneals to the heterogeneous equilibrium region between alpha-brass, and that is in our case, above 650° C, the cooling, due to the slowness of the reaction between the alpha and beta-microcrystals, is even in the open air too rapid to allow of equilibrium in the final state.

Tensile Strength Varies

A part of the beta microcrystals does not go into solution. Due to this beta-brass, which occurs at temperatures somewhat above 650° C, the tensile strength of the wire increases. This high tensile strength, however, falls rapidly off if exceedingly high temperatures are applied. Tensile strength and elongation, as functions of temperature, are represented in Fig. 1.

Sometimes, however, quite a different phenomenon makes its appearance. If one anneals at 650° C, tensile-strength and elongation (expansion) may drop to a decidely low point. This observation has been made *often*, yet *not regularly*. Much more distinct and frequent was such a simultaneous decrease (at 650° C) when the wire underwent double - annealing. The first observations ran as follows: an annealed wire-ring had

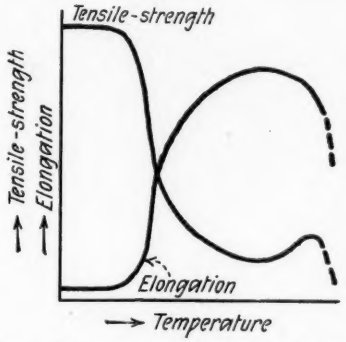


Fig. 1—Annealing of brass wire containing from 63.5% to 64% copper. The figure represents tensile strength and elongation as functions of temperature.

too little elongation; we annealed it a second time, and this second annealing resulted in a marked decrease of tensile strength and elongation. If tensile strength and elongation are simultaneously reduced, the wire substance turns porous and brittle. The phenomenon cannot be characterized as "burning" because the average annealing temperature fluctuated only between 600° C and 650° C, but must be interpreted as a structural change.

We double-annealed a series of brass wire samples of 0.80 mm dia. containing from 63.7% to 63.8% copper, and we determined the elongation and tensile strength of the various samples after the second annealing. Generally, we cooled the wire after the first annealing in the air, sometimes, however, it re-

Fig. 2 Fig. 3 Fig. 4

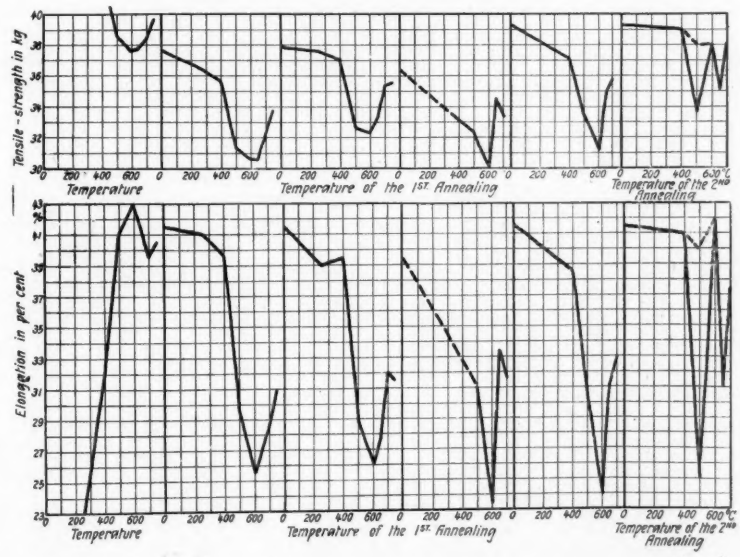


Fig. 5 Fig. 6 Fig. 7

Fig. 2—Tensile strength and elongation of brass wire after annealing at increasing temperatures (Annealed once). Fig. 3—The brass wire of Fig. 2 was annealed a second time at 650 degrees C. Figs 4 to 6 show tensile strength and elongation of other brass wire samples. The first annealing of these specimens took place at various temperatures, the second annealing at 650 degrees C. Fig. 7—The same brass wire as in Fig. 6, the first time annealed at 650 degrees, the second time at increasing temperatures.

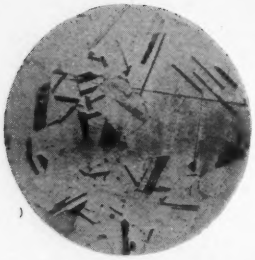


Fig. 8—Brass-wire. Annealed the first time at 600°C, then heated up to 650°C, and again annealed. Pure alpha-brass structure. 41.5% elongation. Tensile strength 38.5 kg per square mm.

Fig. 9—Brass-wire, annealed as in Fig. 8. After second annealing chilled in cold water. Beta-mixcrystals. 41.5% elongation. Tensile-strength 38.4 kg per square mm.

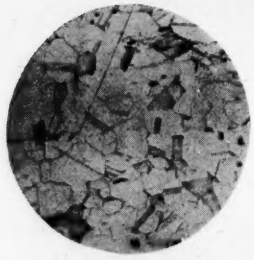


Fig. 10—Brass-wire. Annealed the first time at 700°C, heat reduced to 650°C, wire then again annealed. Air cooled. Remnants of beta-mixcrystals. 27.5% elongation. Tensile-strength 34.6% kg per square mm.

mained in the furnace, and the second annealing temperature was at once applied. Finally, we prepared a third set of samples by cooling the wire in the air and thereupon chilling it in water.

Our results are presented in Figs. 2 to 7. The tensile strength and the elongation curve have the same direction. Hence, it may suffice to merely discuss the elongation curve. Irregularities occur most frequently, if one of the annealing temperatures, especially the second, lies around 650° C. Repeated experiments, however, did not render the same results; the limits of the critical region are narrow and sharp. Even testing of various sections of the same sample sometimes rendered varying results; in one case a wire that had been annealed at 600° C and 650° C, respectively, rendered the following elongation values: 22.5%; 35.0%; and 42.0%. The results of the experiment are briefly summarized in Table 1.

Effect of Chilling

Wire containing from 63.5% to 64.0% copper passes at 650° C from the alpha-state into the alpha plus beta state. Various slides showed that at 650° C only a nominal quantity of the beta-microcrystals came out of solution. Only those samples which retained remnants of the beta-crystals in the structure (compare the air cooled samples reproduced in *Fig. 10 and 11*) show little elongation. If, however, the same type of sample is chilled in water so that the beta-microcrystals remain out of solution (see *Fig. 9 and 12*), or if the cooling process is so

Fig. 11—Brass-wire. Annealed the first time at 650°C, cooled, and again annealed at 650°C. Again cooled in the air. Remnants of beta-mixcrystals. 32.5% elongation. Tensile-strength 35.5 kg per square mm.

Fig. 12—Brass-wire. Annealed as in Fig. 11, chilled in water after the second annealing. Larger quantities of beta-mixcrystals. 40.5% elongation. Tensile-strength 38.2 kg per square mm.

slow that all beta-crystals can go into solution (see *Fig. 8*), then no reduction of the tensile-strength will be noticed.

It is generally known that brass-wire containing from 65% to 67% copper cannot very well be worked in the warm state. At temperatures of 750° C, these alloys approach the limit between the alpha and the alpha plus beta region. It is assumed that the slightest particles of the beta-microcrystals, which may come out of solution, when reacting with the alpha-microcrystals, produce an effect which is typical of impurities, that is to say, under the influence of beta-microcrystals the wire substance turns brittle. It appears that this theory regarding the effect of small quantities of beta-crystals is not only valid if we deal with red heat, but also if we are concerned with wire in the cold state. Whenever we observed a sudden marked reduction of the tensile strength, we also noticed traces of the beta microcrystals in the alpha-structures. (The reverse of this generalization, however, is not true; that is to say, the traces of beta-microcrystals are not necessarily indicative of a marked reduction of tensile strength and elongation.) In such cases, the temperature of the second annealing fluctuated between 640° C and 650° C.

Causes of Brittleness

In experiment No. 3 and No. 8 (see *Table 1*), the structure exhibited has been formed due to: first, relative large amounts of beta-crystals forced out of solution; second, because the second annealing temperature was too low to cause the beta-crystals to go again into solution. In No. 30 and No. 31 (Table D), the characteristics of the structure are due to an exceptionally slow cooling in the progress of which the separated beta crystals went back into solution. Hence, small quantities of beta crystals, which, due to the slow development of the beta transformation, remain on the alpha crystals, constitute the chief cause of brittleness.

The experiments show that the limits of the critical (alpha plus beta) structure are very narrow. Thus, if the beta content changes but slightly that change may be due to somewhat varying cooling conditions or slightly different annealing

temperatures. No marked falling off of the tensile strength occurs.

The experiments made up to this date, as well as our relatively limited knowledge of the alpha and beta phase do not permit of more detailed discussion of the relation between critical region and wire structure. The effects are but slight and seldom perceptible if one anneals only *once* and at a temperature of 650° C, or, if one goes *directly* from the lower temperature of the first annealing to the temperature (650° C) of the second annealing. The effect is more frequent and more marked if the wire undergoes double-annealing. It is remarkable that the decrease in tensile strength runs parallel with the increase in size of the grain; thus increase occurs after the first and second annealing.

Table Showing the Effects of Double Annealing on the Elongation of Brass Wire at Various Temperatures

	First Annealing Degs. Cent.	Second Annealing Degs. Cent.	Elongation	Frequency of Observation	Remarks
1	600	500	normal	once	No. 2 was cooled,
2	650	500	normal	4 times	after the second
3	650	500	marked reduction	once	annealing, with
4	700	500	normal	once	varying rapidity
5	600	600	normal	once	
6	650	600	normal	once	
7	700	600	normal	once	
8	750	600	marked reduction	twice	
9	400	650	slight reduction	once	
10	500	650	marked reduction	4 times	
11	500	650	normal	twice	
12	500	650**	normal	twice	
13	500*	650	normal	once	
14	500*	650**	normal	once	
15	500	640	slight reduction	twice	
16	500	640**	marked reduction	once	
17	600	650	very marked reduc.	4 times	
18	600	650	slight reduction	twice	
19	600	650**	normal	twice	
20	600*	650	normal	twice (once slight)	(See Fig. 8)
21	600*	650**	normal	once	(See Fig. 9)
22	600	640	marked fluctuation	once	
23	600	640**	fluctuating	once	
24	650	650	marked reduction	5 times	(See Fig. 11)
25	650	650**	normal	once	(See Fig. 12)
26	700	650	marked reduction	4 times	
27	700*	650	marked reduction	twice	(See Fig. 10)
28	700	650**	marked reduction	once	
29	700*	650**	marked reduction	once	
30	600	700	very slight	once	
31	650	700	very slight	once	
32	650*	700	normal	once	
33	700	700	normal	once	

(*) Not cooled between the first and second annealing
(**) Chilled in water

Practical Application

The relation between the manner in which the beta crystals come out of solution and the quantitive increase of these crystals cannot be explained except on the basis of hypothetical theories. Our experiments show conclusively that not only the quantitative relation of the alpha to the beta phase, but also the manner of application of the heat treatment, which determines the above relation, condition the unfavorable effects upon the mechanical properties of the wire.

As to the practical application of our experiments, the following rule may be formulated: *repeated* annealing of brass-wire containing from 63% to 64% copper should be avoided, unless the temperature of the second annealing is carefully controlled. One should *not* anneal at temperatures approaching the alpha plus beta region—in our case not at temperatures around 650° C—but *below* or *above* this temperature. (However, even under the prescribed conditions, care should be taken that the cooling process is not too rapid).

Under normal circumstances, annealing at 650° C cannot very well be avoided, because it is in this region that the best elongation values are produced. It should also be noted once more, that, if one anneals only *once* and then at 650° C, a reduction of the elongation occurs but seldom and amounts to no more than 5%, whereas a reduction of from 40% to 20% elongation occurs if the wire is annealed repeatedly.

Summary

The annealing of brass-wire in the proximity of the limit between the alpha and alpha plus beta region has often an unfavorable effect upon the properties of material. This unfavorable phenomenon becomes still more marked if the annealing process is repeated. It has been shown that even very small quantities of beta crystals on the crystalization points of the alpha crystals produce a marked reduction of tensile strength and elongation. It is assumed that traces of beta microcrystals act like impurities upon alpha microcrystals. The limits of the critical region are very narrow. No single reason can be assigned for the causal phenomena which are responsible for the brittleness of the wire substance.

NEWS *of the* INDUSTRY

Foreign Trade Opportunities

FOREIGN trade opportunities reported by the U. S. Bureau of Foreign and Domestic Commerce during the month of October include inquiries from the following sources: For cables, wire and insulating materials (33667) from Copenhagen, Denmark; bolts and nuts for automobiles, for various makes, in assorted sets (33674) Basel, Switzerland; for cable, aluminum, steel cored, (33730) from Seville, Spain; for iron wire (33757) from Budapest, Hungary; for steel wool (33937) from Vancouver, Canada; for steel wool (pot cleansers) (33936) from Toronto, Canada; for steel and galvanized wire (33872) from Valparaiso, Chile; for nail manufacturing machines for making cut floor nails up to 4 inches (33891) Johannesburg, South Africa; for copper wire, hard and soft drawn (34161) from Madras, India; for wiring supplies and fixtures (34160) from Belfast, Ireland; for horseshoe nails, calks, etc., (34183) from Warsaw, Poland; for barbed wire (34179) from Sao Paulo, Brazil.

Our German Nail Imports

The majority of German plants engaged in the manufacture of wire nails are well occupied, according to U. S. Trade Commission, James E. Wallis, at Berlin, and the demand for these products is so brisk that deliveries can not be made in less than three to five weeks. At present (August 2) prices quoted on nails are subject to considerable fluctuation. The highest price which has yet been fixed by the Nail Manufacturers' Association is 24.25 marks per hundred kilos, and applies only on order of more than 5 tons. For smaller quantities additional charges of from 0.75 mark to 1.75 marks per hundred kilos are made. The freight basis is Oberhousen, Rhineland, May exports of nails amounted to 4,800 metric tons. It is noteworthy that the United States was the second largest customer with 900 tons, although this is less than in April when America purchased 1,000 tons. Most of this material is shipped by sea to the west coast and is consigned to San Francisco. None, apparently, is sold on the eastern seaboard.

Propose Standards For Wire Rope

INVITATIONS have been issued to numerous interests to submit data regarding prevailing kinds and sizes of wire rope used in marine service and suggestions for proposed standard specifications. Data and suggestions received are to be digested as a basis for the tentative draft. The invitation comes from the American Marine Standards Committee, which functions as a unit of the Division of Simplified Practice and was formed in 1923 for the purpose of promoting simplification of practice in ship building, ship operation and allied industries.

ANOTHER study of wire-rope and the factors governing its life is to be undertaken by a research committee of the Society of Mechanical Engineers under the sponsorship of the Engineering Foundation. A large number of wire-rope manufacturers and users have already indicated their support of the proposed investigation which is being planned on a large scale. These plans include the construction of a testing machine for wire-rope which can be used to reproduce all the varied service conditions to which such rope is subjected.

Miles of wire-rope are used every year in construction work, oil wells, mines, elevators in buildings, and in industrial plants for many services which affect the safety of lives and property. Users of such ropes have found, however, that their life in service varies greatly and for no clearly understandable reason. Even in elevator installations where the conditions of service are well known and the cables carefully cared for and inspected, there is a wide variation in life. In several such installations investigation has revealed that some of the cables have had three times the life of the others although all were operated under the same conditions, made of the same material, and by the same manufacturer. Because of the disaster resulting from failure many ropes, therefore, are discarded long before the end of their useful life. In the oil fields, in mines and on construction work where the conditions of service are extremely varied and severe the life of wire-rope is, of course, highly problematical.

Some research has been carried on both in this country and abroad to collect the needed information but there is still much data lacking. The metallurgy and processes of manufacturing of the wire, methods of installation and use of wire-rope can all be benefitted by research to the mutual advantage of both maker and user. A conference is at present being planned of technical men particularly interested in the problems and competent to discuss it. At this time the research procedure will be formulated in all its details and a committee personnel proposed.

Personnel Changes

H. Parker, purchasing agent of the Rome Wire Company, Rome, New York, will be in charge of the company's new plant at Mobile, Ala. Stanley O. Williams succeeds him at the Rome office.

Atlas Fence Co., Newark, New Jersey, announce the appointment of Louis A. Hawthorne as development engineer. Mr. Hawthorne was formerly associated with the Carnegie Steel Co. and the General Electric Co.

In order to more adequately serve the large steel producing group, the Vanadium Corporation of America, 120 Broadway, New York, N. Y., has opened an office at 2245-2246 Henry W. Oliver Building, Pittsburgh, Pennsylvania, under the direction of Mr. J. Alfred Miller, Jr., General Manager of Sales of the Vanadium Corporation.

Building and Expansion

Cleveland Wire Spring Co., Cleveland, Ohio, has let contract for a one-story addition to cost about $80,000.

American Coil Spring Co., 1455 West 37th St., Chicago, will remove the present plant to Muskegon, Michigan, where work will soon be started on a new factory unit to cost about $50,000.

Premier Bed & Spring Co., 5700 Third Street, San Francisco, plant to erect a one-story addition to cost, with equipment, about $50,000.

B. Greening Wire Co., Ltd., 55 Queen Street North Hamilton, Ontario, has let contract for a one-story factory addition.

Indiana Wire & Iron Works Company, Lafayette, Indiana, has been organized with a capital stock of one thousand shares, no par value, with the object of conducting a general business of manufacturing, buying and selling of all kinds of wire and iron and metal products. The incorporators are James C. Farrington, Irene L. Farrington, Winfield S. Crum, and Leota M. Crum.

The new wire mill of the United States Steel Corporation at Ojibway, Ontario, is now ready for operation, and it is reported that their new woven wire fence and steel fence post plants at the same point are nearing completion.

Mid-states Steel & Wire Co., Crawfordsville, Indiana, has let contract for a one-story addition to cost about $45,000 with equipment.

Bristol Company, Waterbury, Conn., manufacturers of temperature recording instruments and parts, will erect a one-story addition to cost about $40,000 with equipment.

Strand & Sweet Manufacturing Company, Winsted, Conn., wire manufacturers, have elected Edward P. Jones president to succeed Ralph E. Strand, who has resigned. Mr. Jones is proprietor of the Winsted Steam Laundry.

Gilbert & Bennett Company, Georgetown, Conn., manufacturers of wire cloth, has awarded general contract for a one-story addition.

H. T. McCluskey & Sons, Inc., 525 Grand Avenue, New Haven, Conn., manufacturers of wire cloth, has awarded general contract for a one-story addition.

Foreign Contracts Let

The Central Electricity Board of London, England, has placed contracts amounting in all to about $5,000,000 for the construction of 132,000-volt transmission lines in South-east England, to the Callenders' Cable and Construction Company, of London. The contract for similar transmission lines in the northern part of the area has been awarded to General Electric Company, London.

A contract for approximately $2,500,000 has been awarded to Pirelli-General Cable Works, Southampton, in connection with the Government scheme for the electrification of South-east England. It provides for the laying of a line approximately 300 miles in length which will carry 132,000 volts.

The Dublin Supply Board of Dublin, Ireland, has awarded the contract for a low-pressure distribution network for the Greater Dublin area to Callender's Cable and Construction Company, London. The value of the contract, together with that for high-pressure feeder cables for the same area, recently secured by this firm, amounts to $450,000.

COMING EVENTS

Nov. 13-16. National Association, Railroad and Utilities Commission, at New Orleans. Secretary, J. B. Walker, 270 Madison Avenue, New York City.

Nov. 22-23. Production meeting of the Society of Automotive Engineers at Hotel Book-Cadillac, Detroit, Mich. Chairman of Technical Program Committee, E. P. Blanchard, Bullard Machine Tool Co., Bridgeport, Conn.

Dec. 3-7. Annual meeting of the American Society of Mechanical Engineers, Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Dec. 6. Annual meeting of the Power Transmission Association at Hotel Commodore, New York City. W. S. Hays, 644 Drexel Bldg., Philadelphia, Pa., executive secretary.

Dec. 3-8. National Exposition, Power and Mechanical Engineering, at New York. Secretary, C. Roth, 480 Lexington Avenue, New York City.

Dec. 1-9. Aeronautical Exposition, Coliseum, Chicago.

Dec. 12-14. International Air Conference, Washington, D. C.

Jan. 5-12. National Auto Show, Grand Central Palace, New York.

Jan. 14-18. American Society for Steel Treating, Semi-Annual Meeting, Los Angeles, California.

Jan. 14-18. National Metal Congress, Los Angeles, California.

Jan. 15-18. Society of Automotive Engineers. Annual Meeting, Book-Cadillac Hotel, Detroit, Michigan. Coker F. Clarkson, Secretary, 29 W. 39th St., N. Y. C.

Sleeper & Hartley
TRADE MARK
REG. U.S. PAT. OFF. & PRINCIPAL FOREIGN COUNTRIES

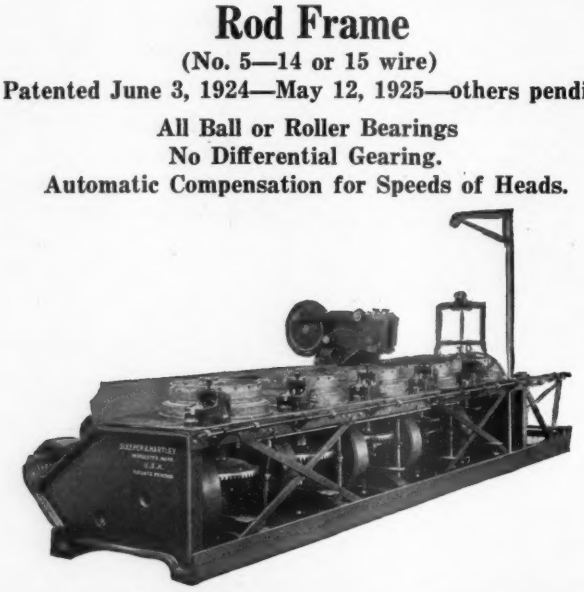
Practical Continuous Wire

These Machines Go Into Production at once—Ready

Rod Frame

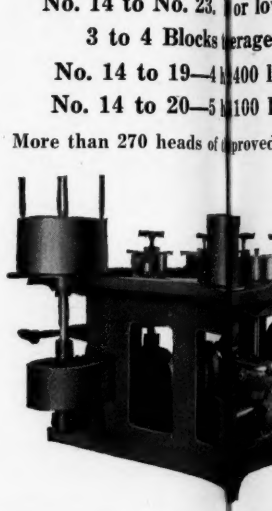
(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending

All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.

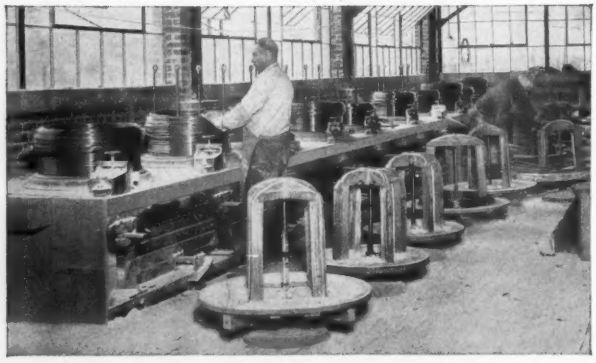


Double 5-Drafty, [illegible]

No. 14 to No. 23, [illegible] or lo[illegible]
3 to 4 Blocks [illegible]erage
No. 14 to 19—4 [illegible]400 [illegible]
No. 14 to 20—5 [illegible]100 [illegible]
More than 270 heads of [illegible]proved

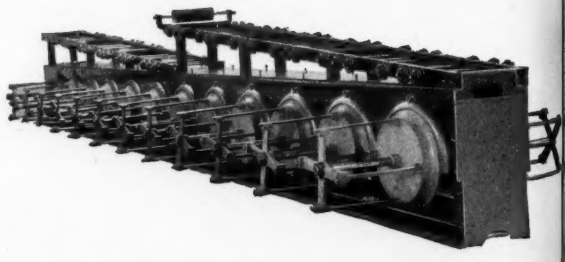


IMPROVED WIRE MILL EQUIPMENT



Standard Rod Frame—10 Block

Long, Stiff Spindles, in anti-friction bearings, and equipped with friction Clutches. Powerful and reliable. Practically noiseless in operation.
(New Plant of Thompson Wire Co., Worcester, Mass.)



Patenting Furnace Take-Up

(New Plant of Thompson Wire Co., Worcester, Mass.)

Do
Direct
frictio
(N

AGENTS: CHICAGO TERRITORY, Noff, Kohlbusch & Bissell, Inc. SAN FRANCISCO AND LOS ANGELES Louis G. Henes

SLEEPER & [illegible]

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London, E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels. MONTREAL AND TORONTO—Arthur Jackson Machine Tool Co.

WORCESTER MA[illegible]

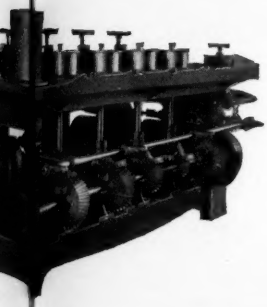
Wire Drawing Machinery

Sleeper & Hartley TRADE MARK

—Reducing Overhead-Increasing Production!!

...fty, Intermediate

...23. ... or low carbon wire.
...cks ...erage Operator.
...4 ...400 lbs. per block.
...5 ...100 lbs. per block.
...s of ...proved model in operation

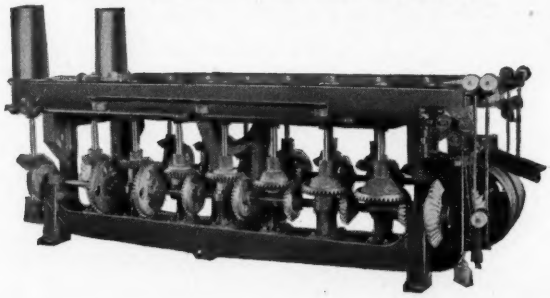


Double 8-Draft Fine Wire: Wet

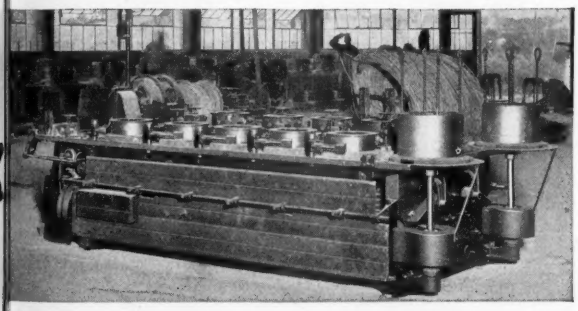
No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousands of these heads in operation



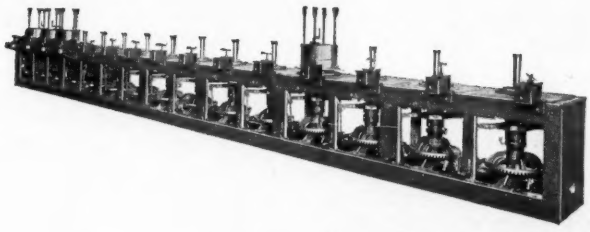
...IENT RECENTLY INSTALLED



Double Six—Draft Dry Continuous For High Carbon Wire

Direct driven with silent chain. Cut gears throughout. Anti-friction bearings. Variable speed for finishing block.

(New Plant of Thompson Wire Co., Worcester, Mass.)



Heavy 16" Frame For .65 Carbon Wire No. 10½ to .037"

15 Blocks: Motor driven. Silent chain. Anti friction bearings and cut gears throughout.

(New Plant of Johnson Steel & Wire Co., Worcester, Mass.)

...ARTLEY, Inc.

Agents: Philadelphia Territory
Swind Machinery Co.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Toyko. SWEDEN AND FINLAND—Maskinaktiebolaget Karlebo, Stockholm.

...ER...ASS., U. S. A.

Causes of Chain Failure Still Undetermined

Recent fatigue and impact tests, supplemented by annealing experiments, result only in tentative inferences

CAUSES of chain failure were discussed in a progress report made to members of the American Society of Safety Engineers who comprise the engineering section of the National Safety Council. The discussion at the October meeting was led by Professor Harold A. Thomas, who described the work that has been done at the Carnegie Institute of Technology.

During the past year, Professor Thomas has made numerous preliminary tests on the fundamental properties of the grade of steel ordinarily used in the manufacture of chains. These properties are considered to have an important bearing on certain questions arising in connection with chain failure and annealing. Fatigue tests were made on straight bar chain stock with a rotating beam machine. Impact tests were also made to determine the effect of impact upon various specimens. In addition certain tests were made to study the effects of annealing and reannealing.

Soft Steel Stock

The test specimens were made of soft steel chain stock, which was supplied through the courtesy of the United States Chain and Forging Company. The specimens were from the stock ordinarily used in making 3/8 inch hand-welded chain, this being a continuous coiled bar, approximately round and about 13/32 of an inch in diameter. These specimens were cut to a length of 13¾ inches, this being the length required by the fatigue-testing machines at Carnegie Institute of Technology. The material of these specimens is a dead-soft steel having a tensile strength of about 48,000 pounds per square inch. Before testing, the specimens were straightened with a copper hammer. In general, the specimens were tested with the surface of the metal in its original condition or as modified by annealing or hammering. In a few of the tests the surface skin was removed by filing and polishing, as noted in the record.

THE test specimens of chain stock used in the experiments here reported were cut from a continuous coiled bar of about 13/32 of an inch in diameter. The material was a dead soft steel having a tensile strength of 48,000 pounds per square inch. Although no final conclusions have been reached, the inferences are important and will be found suggestive.

Final Conclusions Witheld

According to the report submitted by Professor Thomas, it is necessary to withold a final statement of conclusions until the completion of all aspects of the research. Certain inferences, however, are pointed out which appear to stand out clearly as a result of these preliminary tests. These inferences are understood to be strictly of a tentative nature and subject to recall if later work proves this necessary. They are as follows:

Tentative Conclusions

(A) Our tests do not afford any evidence that the "surface impacting" received in service is a contributing cause to the failure of chains. On the contrary our tests on soft steel chain stock invariably show that surface impacting strengthens and toughens the metal, so that its tensile strength is somewhat increased and its fatigue resistance is greatly increased.

(B) Our tests do not show any evidence that the effects of fatigue in soft steel are cured or relieved in any way by annealing. In other words the total number of repetitions of loading which can be carried by a specimen of chain before failure cannot be increased by stopping to anneal the specimen at intervals.

(C) Annealing is capable of reducing the fatigue resistance of chain stock, if extreme care is not taken to exclude all air from the surface of the metal during the annealing process.

(D) There is no surface indication that a sample of chain is at the point of incipient failure due to fatigue from repeated heavy loading.

(E) It is not possible by any pulling test or proof test to discover the fact that a chain is at the point of incipient failure due to fatigue from repeated heavy loading. Even though the fatigue cracks may have penetrated to a considerable depth in the metal at the point of impending failure, a chain may still show its full original strength in a tension test, and finally pull apart in a different place from that at which the fatigue break would have occurred.

Practical Application of Tentative Conclusions

(A) We have not been able to discover any fact regarding the properties of soft steel chain stock which supports the theory that periodic annealing is beneficial in any way to chain used for lifting *cold* loads only, or that such periodic annealing will afford the slightest protection against sudden failure of chain subject to repeated overloading with *cold* loads.

(B) The only possible method for insuring safety against the sudden fatigue failure of chains after long service in handling *cold* loads is a rigid prohibition against using the chain to lift loads greater than safe working

(*Please turn to page 389*)

DIGEST OF RECENT TRADE LITERATURE

Handbook Encyclopedia of Engineering. 1242 pages. The Industrial Press, New York City.

A flexibly bound handbook containing the essential facts about some four thousand subjects in mechanics and engineering, including physical and chemical properties and their applications; manufacturing equipment and processes; mechanical laws, rules and formulas; principles governing design and use of power generating and transmitting apparatus; metallurgy of iron, steel and non-ferrous alloys; definitions of standard and special mechanical words and expressions; and data of interest to designers and builders of mechanical and electrical apparatus. Fully indexed.

Principles of Equipment Replacement. Executives Service Bulletin, June, 1928. P. 1.

The application in a general way of five principles is recommended to the executive confronted with replacement problems: 1. Recognition of the profitableness of power replacement. 2. Constant check on the degree of utilization of existing equipment to determine whether or not it is giving all it can. 3. Continual study of alternative machinery on the market. 4. Prompt replacement where actual obsolescence is indicated, regardless of length of service of equipment in question. 5. Labor and sales policies that permit the worker and the public to share in the benefits secured through the improved machine.

Know Competitive Technical Products. Industrial Sales Topics, September, 1928, P. 1.

Manufacturers in the industrial field have been forced by competition to improve production methods, but the selling of technical products has shown little improvement. In selling a technical product such things as quality, service, the reliability of the manufacturer and even the price are often not so important as the ability of the salesman to present his story from an engineering point of view in such a manner as to gain the immediate confidence of the prospective purchaser. Industrial buyers gladly pay higher prices for technical products sold on the basis of sound engineering.

Handling Costs Cut 25 Per Cent. Manufacturing Industries, September, 1928. P. 329.

How the Pittsfield Works of the General Electric Company economizes on internal transportation. An electric tractor and fifteen trailers are used as the primary handling equipment and are supplemented by electric lift and baggage trucks in connection with either skid platforms or tote boxes. An overhead traveling crane system is used and also hand trucks of various types for miscellaneous haulage.

Trade Literature Received

Braiding and Insulating

"Braiding, Insulated Wire and Wire Rope Machinery." New England Butt Company, Providence, R. I., Loose-leaf illustrated catalogue of machines for twisting and braiding wire and cable and for covering wire with tape, fabric and rubber.

Highway Guard

"Page Highway Guard". Page Steel & Wire Company, Bridgeport, Conn. 32-page illustrated catalogue of woven wire fabric for special fence construction to protect motor traffic on roads, bridges and culverts. The fabric used is a 2-inch square mesh, 24 inches wide, made of 6-gauge Armco Ingot Iron or copper bearing steel wire. Hot galvanizing gives it a light color which adds to visibility. There are detailed reports of tests, pictures of installations, specifications, and instructions for erection.

Material Handling

"Cleveland Tramrail Catalog No. 4". Cleveland Electric Tramrail Division of the Cleveland Crane and Engineering Co., Wickliffe, Ohio. A very comprehensive bound volume illustrating and describing material handling applications in various manufacturing industries. Both hand and electrically operated overhead machinery units and complete systems are included, with engineering data, installation diagrams, specifications, dimensions, shipping weights, prices, etc.

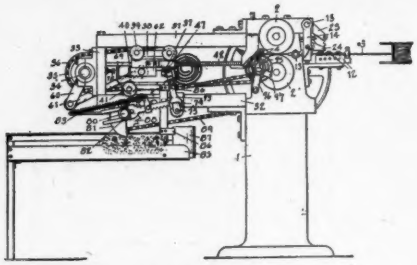
Signal Lights and Sanders

"N-L". The Nichols-Lintern Co., Cleveland, Ohio. 40-page booklet containing descriptions of twenty-two types of N-L Universal Signal Lanterns, together with Lantern Flasher Controls and reflector units for steel mill, factory and highway use. The booklet also contains a detailed description of the Lintern electro-magnetic sander for overhead cranes and of mechanical sanders for locomotive cranes.

Wire Fence

"Fence". American Wire Fence Company, 7 S. Dearborn Street, Chicago, Ill. 24-page illustrated catalogue of woven wire field fence, chain link fence and gates, poultry netting, barbed wire, walk gates and farm gates. Illustrations are from photographs showing industrial, institutional and home uses of the company's products and there are detailed directions for installation.

A REVIEW OF RECENT PATENTS



Wire Spring Making Machine
1,682,949

Complete descriptions and drawings of any of the patents referred to on this page may be had for twenty five cents. Address orders to Wire & Wire Products, 551 Fifth Avenue, New York City.

1,682,949. WIRE SPRING MAKING MACHINE, patented September 4, 1928 by Corban H. Ziler of Carthage, Missouri, Assignor to L. A. Young Industries, Inc., of Detroit, Michigan. A machine for automatically forming, knotting and nesting springs and which is of large capacity. This machine is simple in structure and may be economically manufactured

---

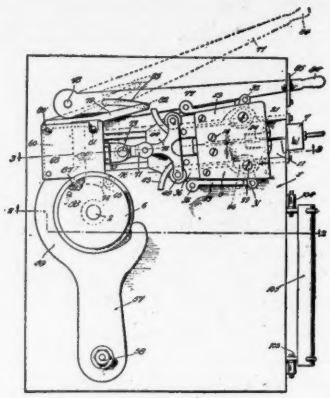
1,683,906. WIRE DRAWING MECHANISM, patented September 11, 1928 by Patrick J. Mahoney of Sharon, Pennsylvania. This invention relates to improvements in wire drawing machines and more particularly to a mechanism whereby the wire may initially be drawn thru the reducing die and connected to the take-up reel of the machine with safety. This device overcomes the perils which usually accompany the performance of such an operation and has for its principal objects the provision of automatic means for initially drawing the wire thru the reducing die until a sufficient length thereof has been drawn thru the die to permit of the end of the wire being connected to the take-up reel of the drawing machine thereby saving considerable time.

1,681,728. MACHINE FOR MAKING SPIRAL SPRINGS, patented August 21, 1928 by John F. Gail of Evanston, Ill., Assignor to Simmons Company of Kenosha, Wisconsin, a Corporation of Delaware. This is an improvement on Letters Patent 810,-048, granted to the same patentee on January 16, 1906. This machine in addition to making coiled wire springs, used in furniture for sitting or laying upon, may be used in the manufacture of wire springs for other purposes and has for its principal objects the provision of a construction more accessible for adjustment and repair purposes; a construction in which the various groups of mechanism performing the different functions are, in a sense, independent; the provision of an improved wire feeding and propelling mechanism; the provision of an improved coiling mechanism whereby the pitch of the coils may be varied independently of the diameter or the convolutions; the provision of an improved transfer mechanism for conducting the coiled spring from the coiler to the knotter, and for delivering the spring; the provision of an improved knotting mechanism; the provision of an improved compressor mechanism for setting the springs before delivery of same.

1,683,610. MACHINE FOR FORMING REENFORCEMENT SUPPORTS, patented September 11, 1928 by Theodore H. Eickhoff of Cleveland Heights, Ohio, Assignor to Pittsburgh Steel Company of Pittsburgh, Pennsylvania, a Corporation of Pennsylvania. This machine for forming reenforcement supports of furring nails is designed more particularly for coiling a spacer upon a nail shank, and consists of means for feeding the nails, one by one, to a coiling head; feeding wire; coiling the forward end of said wire about the nail; bending and cutting the wire, and thereafter ejecting the nail.

1,684,102. WIRE DRAWING APPARATUS, patented September 11, 1928 by Benno B. Leustig and Joseph D. Petsche of Cleveland, Ohio. A wire drawing apparatus relating more particularly to wire drawing dies and holders therefor embodying a die and a holder therefor, arranged in a novel manner whereby the die proper will embody a minimum amount of steel in its construction and be of such shape that it may be economically produced and when in use function efficiently. The die holder construction provided in this invention may be rapidly taken apart to permit the insertion of a die therein whereby the accurate positioning of the die becomes a mere incident to the reassembling of the parts comprising the die holder.

1,685,439. NAIL MAKING MACHINE, patented September 25, 1928 by Robert W. Strout of Brooklyn, New York, Assignor by mesne assignments to E. W. Bliss Company of New York, New York, a Corporation of Delaware. A machine for making wire nails capable of operating at a higher speed than those generally used. This device is of that character which automatically feeds wire from a coil or reel into a clamping die which grips the wire, leaving a sufficient length



Wire Drawing Mechanism 1,683,906

thereof protruding to form the head, which then is swaged down against the die by means of a reciprocating hammer, after which the die opens and the wire is fed forward a distance corresponding to the length of the nail to be made, and is then cut off and falls, or is knocked out, into a chute or hopper.

1,684,723. WIRE TYING OR TWISTING DEVICE, patented September 18, 1928 by Archie E. Bass of Baltimore, Maryland, Assignor of forty-nine per cent to Ethel Strasmich of New York, New York. This device is an improvement in wire tying or twisting devices which are generally used for twisting together the two ends of a binding wire, which has been passed around an article, or around a plurality of articles to be secured together. Among the particular objects of this device is the provision of means for causing a binding wire to be extended around articles to be secured together and thereafter automatically imparting a twist to the adjacent ends of said wire, whereby to secure the latter in its position around the article or connected articles; means adapted to automatically cut off the desired length of wire immediately prior to the twisting operation and means for so adjusting the device that the shearing means will cut off a binding wire of any desired length.

1,684,838. WIREWORKING DEVICE FOR STITCHING MACHINES, patented September 18, 1928 by Ernest Leschhorn of Chicago, Illinois, Assignor to Latham Machinery Company, a Corporation of Illinois. The principal feature of this invention is the provision of single means for simultaneously adjusting the feeding mechanism and the cutting mechanism in such a manner that when the feed rolls are adjusted to vary the length of wire fed, the cutter mechanism is automatically and simultaneously adjusted in its position with respect to the staple forming and driving mechanism.

A New Cable Clip

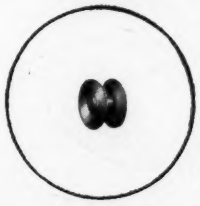
A CABLE clip with a considerably larger holding surface has been put into production, in a full range of sizes, by the Eureka Metal Products Corporation of North East, Pa. It is a patented clip which, according to tests, has shown its ability to carry three times the maximum load of an ordinary clip—and gives equally good results both on wire rope and messenger strand.

The Eureka Clip, according to the manufacturers, gives triple safety because of its triple grip. Any size wrench can be used to tighten up the Eureka Clip. There is no chance whatever of injury to the cable, regardless of the size wrench that is used—no restriction on the length of wrench handle is necessary. This clip's double grooved surface prevents any distortion of the cable, no matter how tight the nuts are pulled down.

And there is no restriction on the way in which these clips are placed on the cable—it doesn't matter which way the U-bolt is turned.

Savings reported, include a very considerable saving in cable because there is no cutting of the strands by U-bolts. The scored surface cannot injure the cable, no matter how tight the clip is pulled up. There is also a direct saving in clip cost, and a very considerable saving in labor, because fewer clips are needed. These patented clips are made in all sizes of steel or bronze.

2½ INCHES *or* 8 FEET



WHATEVER your requirements for handling your product during all the processes of manufacture—annealing, braiding, stranding, vulcanizing, impregnating, or for shipping—"American" Pressed Steel Reel or Spool will do the job better and remain on it longer.

Made in standard types from 2½ inches in diameter to 8 feet. Special Reels or Spools to your specifications. Write for catalog.

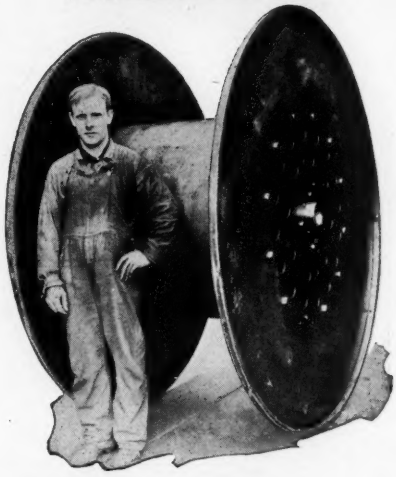
"AMERICAN" Pressed Steel Reels and Spools are practically indestructible. More easily handled because they are *balanced.* Stronger and more rigid because of their unique design of pressed steel. *Always true to gauge* as specified — they are made with the same precise, honest workmanship as are "American" Belt Pulleys and Shaft Hangers.

The American Pulley Company

Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes

4200 Wissahickon Avenue Philadelphia, Pa.

AMERICAN PRESSED STEEL REELS



PATENTS
TRADE-MARKS
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Evidence of Conception

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request.

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A Special Mossberg Pressed Steel Spool

One of the many Mossberg specialties. For handling stitcher wire that is furnished by the manufacturer in standardized commercial coils of five and ten pounds. There's a Mossberg spool for every purpose.

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Diamond Dies Giving Uniformity in Production

ACCURATE DEPENDABLE
REASONABLE IN PRICE

USED FOR YEARS IN LEADING WIRE MILLS
Our experts will solve your die problems.

Write for information about Dependable Diamond Dies

BALLOFFET DIAMOND WIRE DIES, Inc.

342 Madison Ave. New York City

Chemical Tests of Wire

(*Continued from page 370*)

potassium permanganate until a permanent pink color is formed.

A solution of permanganate containing .564 grams of potassium permanganate crystals per litre is a very useful one. 1 cc. of this solution = .001 grams of iron. Therefore, if the titration took 30 ccs., the weight of iron = .001 X 30 = .03 grams.

Deduct the final weight of the sample after treatment in the lead acetate solution from the original weight of the sample and the loss in weight is the weight of the zinc coating. Divide this weight by the original weight of the sample, multiply by 100 and this gives the percentage loss in weight near enough for all practical purposes.

Example:—

Weight before treatment = W grams.

Weight after treatment (in lead acetate) = W_1 grams.

Loss $w = W - W_1$ grams.

$$\text{Percentage loss} = \frac{w \times 100}{W}$$

It is often advisable to calculate out the number of ounces of coating per square foot, which gives a unit and may be used for purposes of comparison.

In this test and also in the French Government test it is necessary that the wire be smoothly galvanized without any adhering lumps or drops of spelter, as these would give an entirely false result as to the protective coating.

Caustic Soda Test

This is a galvanizing test which shows the presence or absence of pores or cracks in zinc coatings. A strong solution of Caustic Soda in water is heated to a temperature of 100°C. and the galvanized article is suspended in this solution by a string or other non-metallic suspension. If pin-holes or cracks exist in the coating bubbles of hydrogen will be observed to

come from the surface of the article at these points, while, if there are no holes or cracks in the coating, no action will be observed. The Caustic Soda test is very useful for showing whether or not the articles have cracked in being bent and is also a good test to show if the spinning of the wire into a rope has affected the zinc coating.

Another test, which is also very useful and which is claimed to be well adapted to making comparisons of the durability of zinc coatings applied by the various means, is known as the salt spray test.

Salt Spray Test

The object of the application of metallic coatings, such as sherardizing, hot galvanizing, electro galvanizing, etc., is to enable the coated articles to resist atmospheric conditions without rusting for a longer time than they could withstand such exposure had they not been coated. Obviously then, the best method of testing the efficiency of the coating is to submit the articles to conditions similar to those which the articles are supposed to withstand in service. The most commonly used methods of testing these metallic coatings are chemical attacks, but, as already pointed out, these methods simply give a measure of the thickness or the weight of coating per square foot.

The Salt Spray test, however, is different, in that, although it does not give the thickness of coating or the weight, it gives a good idea of how the articles will withstand the conditions to which they are required to be subjected. In short, the Salt Spray test is simply a test as near the actual conditions of service as possible.

The test consists of exposing the articles in a copper lined box, into which is projected by compressed air an atomized spray of a solution of sodium chloride in water containing 2½% by weight sodium chloride. Care must be taken to avoid placing the articles directly in the path of the jet because the individual sprays would play

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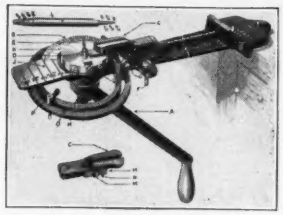

Patented April 2, 1918

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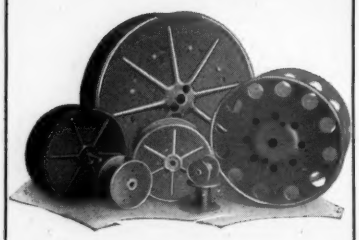

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(*Continued from page 385*)

directly on one spot and produce erosion. In order to ensure constant saturation an excess of salt is kept in the water at the bottom of the chamber. The spray is produced by a jet of compressed air lifting the water to the nozzle, whence it is projected as a cloud.

The apparatus is of the common atomizer type. The chamber should not be tightly sealed but is open sufficiently to permit breathing; when used with an air jet there is a slight pressure and this is relieved through the breathing openings. If desired, the temperature of the atmosphere in the chamber may be increased by the use of a jet of steam. The Specific Gravity of the water is kept at 1.026 and 1.03 at 60° F. It is possible by suitable additions to the water in substitution for the salt to render the atmosphere slightly acid or alkaline.

From the above tests and the results obtained we can sum up as follows.

Summary of Conclusions

1. The Copper Sulphate test of Preece is of value in determining the uniformity of the coating and the thinnest portion of it, of articles coated by the hot and wet methods of galvanizing, but it is useless when applied to sherardized articles. Sherardized coatings show, as a rule, copper deposited over the zinc coating when tested with copper sulphate solution, hence no reliance can be placed on the tests and the Copper Sulphate test gives no idea of how the product will withstand durability.

2. The French Government and the Lead Acetate tests are very similar; both give excellent results and either can be used for determining the amount of zinc deposited per unit of area.

3. The Caustic Soda test gives evidence of the continuity of the coating and the presence of any unprotected iron is readily seen. It also furnishes a test as to how the galvanized product will stand the bending test. Hot galvanized wire usually

shows poorly distributed coatings and poor results after bending.

Electro galvanizing provided it has been applied properly with a hydrogen free solution and that care has been taken that the zinc is pure, uniform, and not porous, stands up better for all the tests.

Another test which is sometimes applied to wire is its solubility in sulphuric acid.

Description of Method:

(1) Length of wire to be the individual sprays would play tested—120 m/m.

(2) Acid composition—1 part of pure concentrated sulphuric acid : 99 parts of water.

(3) Volume of test vessel—minimum 100 cubic centimetres for one wire.

(4) The vessel named under (3) must be filled every 24 hours with fresh solution. Moreover, every 24 hours, the wires being tested must be cleaned under running water with a soft brush.

(5) After a period of 120 hours the wires are taken out, cleaned, dried and weighed.

The length of wire is cleaned to remóve any grease or dirt and carefully weighed, the weight being noted. It is then placed in the test vessel and covered with the sulphuric acid. After every 24 hours it is taken out, cleaned, and placed again in the test vessel with fresh solution. This procedure is carried on until 120 hours have elapsed, when it is taken out, dried, and again weighed. The loss in weight is calculated out on the surface area exposed of the original wire and the loss is generally quoted as—loss in milligram per square centimetre area exposed.

This test is very useful for two reasons:—

1. It gives a good idea of how the wire will stand atmospheric conditions.

2. In some cases it is a safeguard against over drawing, it being a well established fact that cold work increases the solubility to a marked extent. It would not, however, be correct to say that, because a wire

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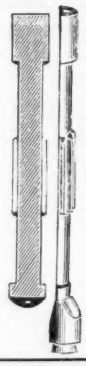
Netting Pinions for Wire Netting Machinery

(For hexagon and triangular netting) made from a Special Steel of about 70—80 kg solidity, and

hardened Screws (bushes for same)

First class workmanship, in all sizes wanted, as per sample or drawing.



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has a high solubility, it has been overdrawn, because the solubility in sulphuric acid depends most of all upon the nature of the steel. This has been proved in many cases and a Swedish steel wire, which had been drawn only 3 passes, had solubility three times as high as another rod of English manufacture which had been drawn 5 passes.

It has nevertheless been found that, when other factors are duly considered, the percentage increase in solubility due to drawing forms a rough guide as to the amount of reduction by cold working a wire has received. Some typical figures for three grades of steel are given in the accompanying tables.

Service Data Reveals Quality of Trolley Wire

(*Continued from page 372*)

Power Company, Atlanta, Ga.: (1) All 000 round; 1,139,786 ft. copper; 133,188 ft. phono-electric; 18,841 ft. cadmium. (2) Not known. (3) 0.132. (4) 000 copper trolley wire. (5) Yes.

Cleveland Railway, Cleveland, Ohio: (1) 1,570,112 ft. 00 standard hard drawn, 98 per cent conductivity, round; 495,794 ft. 00 phono-electric and silicon bronze 40 to 45 per cent conductivity, round; 1,600 ft. 000 phono hard-drawn, 40 to 45 per cent conductivity, grooved; 157,880 ft. 0000 standard hard-drawn, 98 per cent conductivity, grooved. (2) Line crews are furnished with a chart giving tensions corresponding to temperatures at 10 deg. intervals. (3) For the year 1927: .114 breaks per 100,000 car-miles per month; for the half year of 1928; .072 breaks per 100,000 car miles per month. (4) 00 round, standard hard-drawn. 00 round, alloy, where abnormal wear is experienced. (5) Yes, where practical.

Hamilton Street Railway, Hamilton, Canada: (1) 40 miles. (2) 18-in. sag to 100 ft. (3) Ten breaks per year. (4) 0000 round. (5) Phosphor bronze.

Causes of Chain Failure Still Undetermined

(*Continued from page 380*)

loads, such as those recommended by the National Safety Council. These working loads are far less than the chain can carry without breaking in a single lift, but cannot be exceeded without stressing the metal in certain parts of the link beyond its endurance limit, and causing its eventual failure.

Causes of Crystalline Fracture

As a result of the work now accomplished, it has become evident that out of the numerous causes for the failure of chains, there are only certain ones that produce an effect which could be remedied by annealing. The latter are apparently all of a type tending to produce a crystalline fracture in the metal of the links. Failure with this type of fracture is accompanied by little or no elongation of the metal, and under certain conditions may occur without warning and at comparatively small loads. The following list summarizes the causes which have been brought to our attention as being capable of producing a crystalline fracture in a wrought iron or steel chain link, aside from original defects in the metal.

a. Fatigue of the metal due to repeated loading.

b. Failure caused by a load applied suddenly.

c. Crystalline structure produced in the metal of certain parts of the link during the welding operation by high temperature and insufficient working.

d. Crystalline structure caused by prolonged exposure of the metal to dull red heat (Stead's brittleness).

e. Cracks starting in a brittle surface skin produced by numerous blows and impacts received in service.

f. Cracks starting in a brittle or weakened surface skin produced by rusting.

g. Severe bending and abuse of links in certain parts of the chain, involving a much

(*Continued on page 392*)

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ONLY thoroughly clean wire will take a good "sharp" pickle without excessive acid consumption. And, by using an Oakite solution you can be certain that your wire *is* absolutely clean.

Oakite cleaning removes *all* grease and oil, leaves each coil film-free—ready for the pickling bath, enables acids to work more quickly, more effectively, and holds acid consumption down to dollar-saving limits.

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Broden Construction Co.
Wire Mill and Cold Rolling Equipment
10255 Harvard Ave.
CLEVELAND, OHIO

Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries

August, 1928

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Belgium	5,584	.....	.....	.....	.....	.....
France	840	.....	.....	.....	.....	.....
Germany	.....	.....	.....	378	.....	.....
Irish F. State	40,320	.....	.....	.....	.....	7,504
Italy	216	.....	.....	.....	.....	.....
Netherlands	.....	.....	.....	3,080	.....	.....
Rumania	.....	.....	.....	11,952	.....	.....
Soviet Russia in Europe	20,300	.....	.....	47	7,088	.....
Switzerland	2,000	.....	.....	.....	.....	.....
U. Kingdom	113,313	56,079	.....	.....	.....	8,440
Canada	1,915,297	816,455	332,105	172,366	9,023	81,507
B. Honduras	.....	.....	.....	.....	.....	318
Costa Rica	.....	11,925	500	131	.....	14,000
Guatemala	.....	.....	127,300	2,430	.....	4,000
Honduras	.....	4,001	259,350	3,194	.....	27,505
Nicaragua	4,030	3,828	99,996	735	8,285	61,837
Panama	.....	6,415	182,230	13,254	.....	91,245
Salvador	300	3,895	82,000	2,625	.....	7,000
Mexico	374,583	257,605	1,485,978	201,094	3,252	45,314
Miquelon & St. Pierre Is.	.....	.....	.....	.....	.....	500
Newfoundland & Labrador	200	44,816	.....	176	.....	750
Bermudas	.....	.....	.....	.....	.....	1,400
Jamaica	25,000	1,139	.....	1,895	47	52,334
Trinidad & Tobago	.....	72	.....	15,414	.....	.....
Other B. W. Indies	702	1,141	.....	150	115	24,300
Cuba	38,500	90,132	813,139	33,624	2,779	775,122
Dom. Rep.	7,336	4,259	163,875	1,962	122	34,017
Netherland West Indies	1,000	100	27,500	2,159	739	11,400
Haiti, Rep. of	.....	1,007	.....	.....	.....	8,400
Virgin Islands of U. S.	.....	.....	1,150	313	.....	4,763
Argentina	2,250,103	602,056	1,365,094	4,190	10,063	4,800
Bolivia	.....	830	.....	28,766	.....	.....
Brazil	372,567	91,680	2,996,853	9,775	228	.....
Chile	11,112	.....	.....	31,199	.....	1,588
Colombia	4,400	35,631	1,482,874	30,038	545	156,426
Ecuador	447	.....	.....	.....	135	27,378
Surinam	.....	441	.....	.....	.....	.....
Paraguay	.....	.....	.....	6,072	.....	.....
Peru	.....	.....	600	226,610	.....	33,640
Uruguay	13,588	90,646	115,167	.....	.....	.....
Venezuela	36,869	20,466	606,176	95,770	.....	69,868
B. India	.....	.....	83,266	26,547	.....	.....
B. Malaya	.....	85,125	40,000	.....	.....	400
China	618	86,974	.....	24,559	.....	114,899
Java & Madura	750	.....	116,402	.....	.....	.....
Other Netherland E. Indies	.....	.....	59,750	74,327	.....	.....
Hong Kong	.....	151,881	.....	.....	.....	.....
Japan	3,613	203,400	.....	17,900	.....	.....
Philippine Islands	87,950	14,552	534,100	93,150	2,998	346,077
Soviet Russia in Asia	.....	.....	.....	.....	.....	1,990
Australia	190,118	24,751	219,720	.....	.....	.....
B. Oceania	.....	.....	.....	.....	.....	6,540
F. Oceania	.....	120	.....	.....	.....	.....
N. Zealand	247,390	126,784	41,400	.....	.....	797
B. E. Africa	.....	150	.....	.....	.....	.....
Union of South Africa	.....	56,000	52,033	.....	.....	30
B. W. Africa	.....	.....	.....	.....	14,000	.....
Other F. Africa	.....	.....	.....	443	1,740	.....
Liberia	.....	.....	.....	.....	.....	400
Mozambique	.....	.....	101,000	.....	.....	.....
Total Quantities	5,769,046	2,894,356	11,389,558	1,140,725	61,159	2,026,489
Total Value	197,139	78,488	312,834	144,332	9,734	62,976
Shipments from						
Shipments from the United States to Non-Contiguous Territories.						
Alaska	.....	.....	.....	.....	.....	62,452
Hawaii	29,040	126,662	19,414	42,524	.....	171,154
Porto Rico	19,209	22,573	302,988	4,821	107	352,214

August Exports

DELAY in the preparation of the Department of Commerce figures showing domestic exports of Iron and Steel manufactured products for August, i. e., woven wire, woven wire fencing, screen cloth, horseshoe nails and horseshoes accounts for their absence in this month's issue.

The figures above indicate the heaviest increase, as compared to July, in exports of Plain Wire, shipments of which exceeded the July total by 2,418,713 pounds. There was a slight increase in exports of Wire Rope. Barbed Wire figures are approximately the same as for July, whereas Insulated and Wire Nails show slight decreases.

BRITISH TRADE NOTES

Australian Mill Completes Huge Rope

A NOTEWORTHY success has just been achieved in the manufacture of a large compound construction colliery haulage rope in four lengths, each half a mile long, by the Australian Wire Rope Works, Limited, at their Newcastle Works. The rope is 4¼ inches in circumference, and is made of six strands, each of sixteen wires over a hemp core. The wires in the strands are laid nine over six over one, the nine outer wires being drawn without braze or weld thoroughout each length. The steel used is of 110/120 tons tensile, of "special acid" grade, and the completed rope is a fine example of the excellent work which is being turned out at the above works.

This rope is for the use of an important colliery in the Newcastle district, and by special invitation the manager of the colliery was present at the testing. The rope was tested to destruction on the 100 ton Denison testing machine, and broke at 73.8 tons, which shows a substantial margin above the guaranteed breaking strain of 70.4 tons, thus fully demonstrating the high quality of the rope supplied.

New Rope In Process

Another important rope now in course of manufacture is one for a large haulage system in Victoria. This rope will be 12,000 feet long, and will be made in one piece without splice or join. The description is 3⅛ inches circumference, 6 x 7 "acid" rope of 80/90 tons tensile. The completed rope will weigh 8¼ tons net, and will be of 100 per cent Australian production from the crude ore to the finished rope, the wire being drawn in Newcastle from Australian steel.

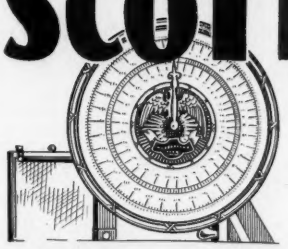
The new Australian industry is quite striking the high spots, and all Australian users are loud in the praises of the home made article, and of the high quality maintained.

Cable Makers Adopt Mark

THE various concerns belonging to the British Cable Makers' Association have announced the marketing of rubber insulated electric cables, without any layer of pure rubber next to the conductor, under the trade-marks "Vicma" and "Vinazo." The former corresponds in quality to the standard C. M. A. grade of cable and the latter to the "Nonazo," or non-association class. Similar qualities have been manufactured by certain firms for many years for export to tropical countries and also to places involving the cable in a journey through the tropics. These cables may also be preferred in certain situations in industrial work in Europe and America, such as for the hot damp conditions frequently encountered in steam laundries and chemical inertness, specially fitting them for installation work in corrosive and fume-laden atmospheres.

Until the recent registration of these two new trade-marks, firms who manufactured such cables sold them as specialties of their own and not as C. M. A. cables. Now, however, they will rank for the usual rebates under contracts for Association and non-association cables, and the trade buyer can select cables with or without a coat of pure rubber next the conductor, according to the conditions under which it is to be used. Under the Institution of Electrical Engineers' regulations for the electrical equipment of buildings issued in 1924 the new types would not have been permitted, but the 1927 addition amended the specification and they now comply in every respect.

SCOTT



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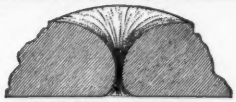

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Accurate Size Smooth Draw

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WIRE DIE WORKS

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(*Continued from page 389*)

greater deformation of the metal than is ordinarily considered in fatigue tests.

h. Effect of extreme cold weather in decreasing the ductility of the metal and lowering its resistance to the actions listed above as tending to produce crystalline fractures.

Note: In addition to the above, mention may be made of the belief which is current among workmen and others that iron or steel of good original quality can deteriorate or "crystallize" in ordinary service without being subjected to heating, corrosion, or to severe or repeated loadings. Although few men of technical training share in this belief, it would seem desirable to include in our program a fair experimental demonstration of the existence or non-existence of such an action in connection with failures of chain.

Worcester Wire Mills Report Improved Business

(*Continued from page 367*)

put, finds business good, with an excellent prospect.

The Thompson Wire Company is fairly busy at its Worcester plant, the capacity of which was doubled last year. The mills manufacture fine tempered wires.

Howard W. Nester, vice president of the Parker Wire Goods Company, sums up the situation as follows: "We are just passing through the seasonal slack period of the year. The general activity seems to be greater than one year ago. In our opinion, the outlook for the ensuing months of the year in the wire industry is much more favorable than it was in 1927, and we anticipate materially increased volumes of business in from thirty to sixty days. Our capacity in equipment and buildings has been increased approximately ten per cent in the past year, and we have added several new lines to our products."

BUYERS' GUIDE

For more complete information, consult the annual Directory, Index & Buyers' Guide.

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Vaughn Machinery Co., Cuyahoga Falls, O.

CLEANING COMPOUNDS
Oakite Products, Inc., N. Y.

CRANES
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Chilled Iron
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Diamond
Ballofet Diamond Wire Dies Co., Inc., N.Y.C.
Bellet & Bouvard, N. Y.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Union Wire Die Corp., New York, N. Y.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Works, New York.
Waterbury Wire Die Co., Waterbury, Ct.

DIES—Repairs & Re-Cutting
Ballofet Diamond Wire Dies Co., Inc., N.Y.C.
Bellet & Bouvard, N. Y.
Cochaud Wire Die Corp., New York.
F. Krause & Co., Inc., Jersey City, N. J.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Wks., N. Y.

DRAWING COMPOUNDS
Oakite Products, Inc., N. Y.

FURNACES—Wire Annealing
Vaughn Machinery Co., Cuyahoga Falls, O.

GAUGES—Wire
A. Waldeck & Co., Cleveland, Ohio.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

LOOMS—Wire Weaving
M. A. Irmischer, New York.

LUBRICANTS—Wire Drawing
Adam Cook's Sons, Inc., New York City.

MACHINERY—Armoring (Cable, Wire, Hose)
J. I. Bernitz, New York.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson.

MACHINERY—Cutting
J. I. Bernitz, New York.
The F. B. Shuster Co., New Haven, Conn.

MACHINERY—Coiling
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Chain Forming
J. I. Bernitz, New York.
M. A. Irmischer, New York.

MACHINERY—Electric Chain Welding
J. I. Bernitz, New York.
M. A. Irmischer, New York.

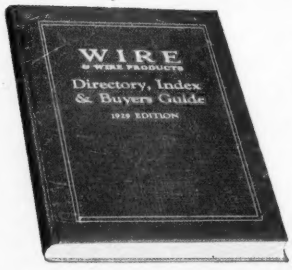
MACHINERY—Forming
J. I. Bernitz, New York.
M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. D. Kilmer & Co., Cleveland, Ohio.

MACHINERY—Gem Clip
J. I. Bernitz, New York.
M. A. Irmischer.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
New England Butt Co., Providence, R. I.

MACHINERY—Nail
J. I. Bernitz, New York.
M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Pointing
M. A. Irmischer, New York.
Morgan Construction Co., Worcester, Mass.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrell Foundry & Machine Co., Waterbury, Conn.



Are You Listed?

TO make this 1929 Wire and Wire Products Annual Directory as complete as possible, names of manufacturers and their products are being assembled now for careful revision before publication three months hence. Your name will be listed without charge or obligation under the headings you indicate.

Rates for advertising space in units of from one inch to full pages will be supplied on request. Very moderate rates are also available for Bold Face display listings in heavy type that makes the listing inescapably prominent when consulted by the reader.

You are urged to fill out this form **now** to avoid the possibility of having your name omitted from the contents of the Directory.

LISTINGS
(Specify Kinds of Wire, Wire Products, or Wire Mill Equipment)

.....
.....
.....
.....
.....
.....

Wire & Wire Products,
551 Fifth Avenue, New York City.

You may list our name, without charge, in the forthcoming issue of Wire & Wire Products Directory, Index and Buyers' Guide under the headings here indicated and send us particulars about advertising rates and rates for Bold Face display listings.

Name .....

Address .....

City .....

BUYERS' GUIDE, Continued

MACHINERY—Pin & Needle
J. I. Bernitz, New York.
M. A. Irmischer, New York.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Second-hand
Jesse Atherton, Providence, R. I.

MACHINERY—Spring Making
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. A. Irmischer, New York.

MACHINERY—Straightening
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. A. Irmischer, New York.
F. B. Shuster Co., New Haven, Conn.

MACHINERY—Stranding
J. I. Bernitz, New York.
M. A. Irmischer, New York.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Machinery Co., Phila.
M. A. Irmischer, New York.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Testing
Henry L. Scott Co., Providence, R. I.

MACHINERY—Trolley Wire
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Winding
J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
M. A. Irmischer, New York.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

NEUTRALIZING COMPOUNDS
Oakite Products, Inc., N. Y.

PATENTS
Lancaster & Allwine, Washington, D. C.

REELS—Annealing
American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

PRESSES—Rivet & Bolt
M. A. Irmischer, New York.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

SPOOLS—Wire & Cable
American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
R. B. Hayward Co., Chicago, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

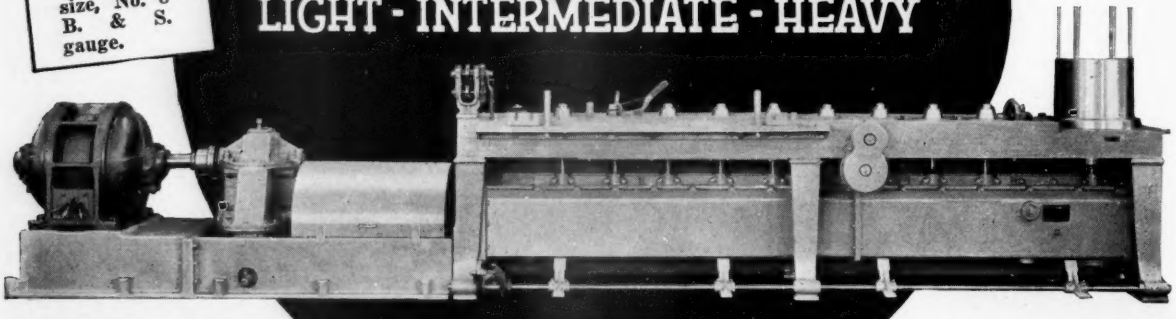
This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

WATERBURY-FARREL

UPRIGHT ROLL
Continuous
WIRE DRAWING MACHINES
LIGHT - INTERMEDIATE - HEAVY

Illustration shows No. 3 intermediate 10-die machine, motor drive. Starting size, No. 8 B. & S. gauge.

Straightaway construction—Forced feed lubrication. Ball bearings throughout.



WATERBURY-FARREL FOUNDRY AND MACHINE COMPANY

HOME OFFICE AND WORKS:
Waterbury, Connecticut, U.S.A.

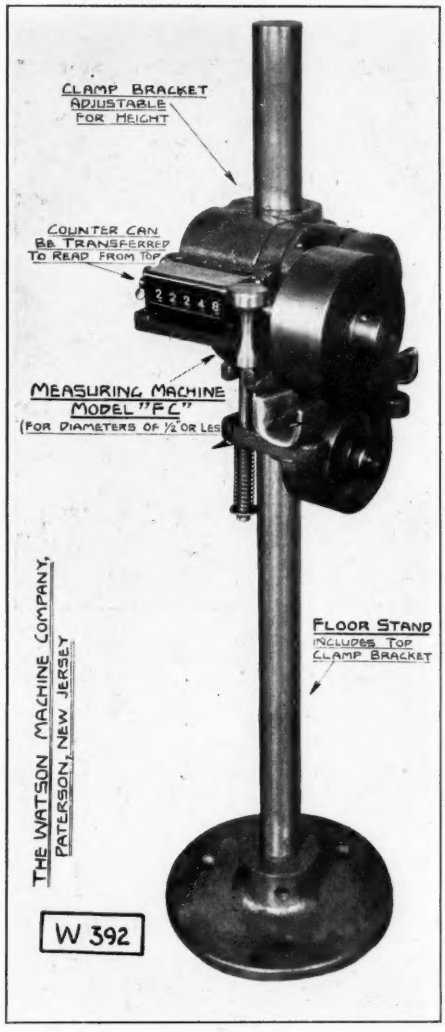
WESTERN SALES OFFICE:
1016 Williamson Bldg., Cleveland, Ohio

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

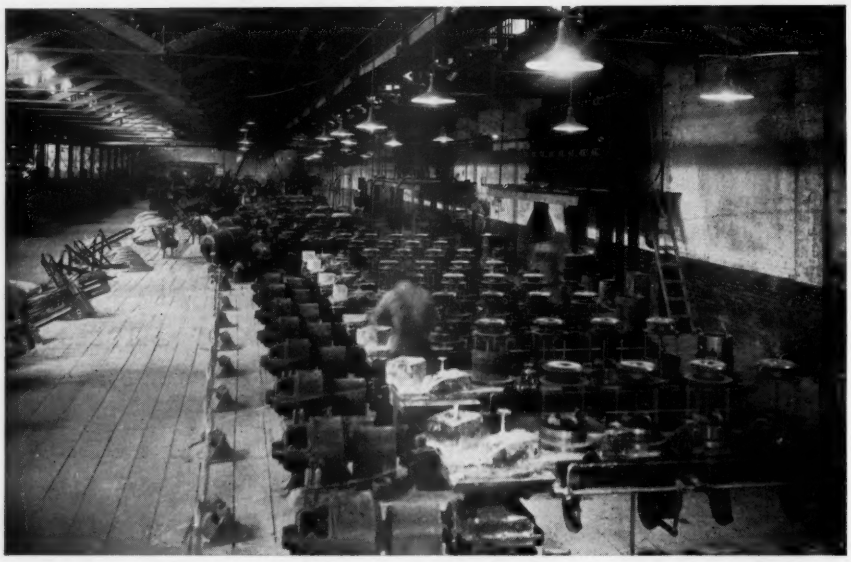
ENGINEERS - FOUNDERS - MACHINISTS



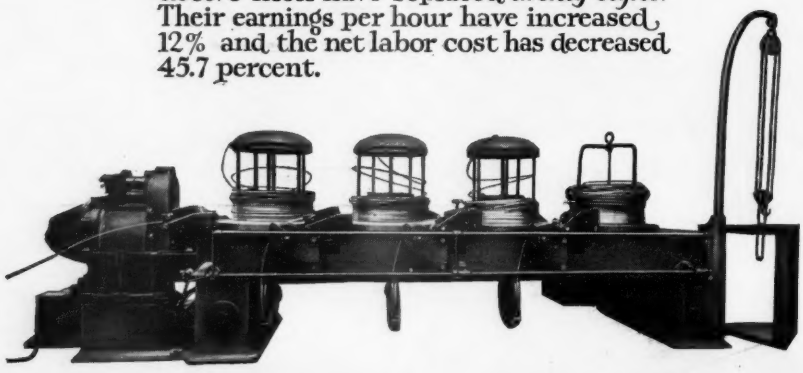
Can Be Used
For Measuring
Flats, Strips
or Sheets
By Removing
Guide Funnels

ELECTRICAL WIRE AND CABLE
WIRE ROPE and CORDAGE MACHINERY

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS



Through this installation of
Morgan Connor Wire Machines
twelve men have replaced *twenty-eight.*
Their earnings per hour have increased 12% and the net labor cost has decreased 45.7 percent.



MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS, U.S.A.